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Advanced Steam Conditions

Endeavours to Reduce Fuel Costs

FUEL costs are likely to be even more a predominant consideration in the design of steam power stations in the future than they have been in the past. The reason is two-fold: the price of coal everywhere is on the increase, and load factors tend to improve, giving a greater spread over of capital charges. For either reason running charges assume greater relative importance. Hence, efforts to improve thermal efficiency through the adoption of higher steam pressures are likely to become more strenuous.

Many experienced engineers have held the view that above about 1,400 lb. per sq. in.—at which point the highest temperature of steam permissible on metallurgical grounds (without reheating) is required in order to avoid undue wetness at the turbine exhaust—any theoretical gains are outweighed by commercial and operation factors. Such doubts lend more than usual interest to the results, reported in this issue, that have been achieved at Twin Branch station (Indiana) during its first few months of running.

Two outstanding features of this station are the adoption of 2,400 lb. per sq. in. and the raising of steam at so high a pressure in a Babcock boiler of the natural-circulation type. This principle has held the field hitherto in the United States, where the first forced-circulation unit in a public supply station will be the 650,000 lb. per hour La Mont boiler for 2,000 lb. per sq. in. now being built for the Montaup station (Mass.). The European tendency, however, has been to employ forced circulation, instead of high head, to cope with the rapid diminution, with increasing pressure, of the difference between the specific weights of water and steam, upon which circulation normally depends.

Reheating of the steam between the high and low-pressure cylinders, which has been utilised in Britain largely for improving thermal efficiency, becomes necessary at such pressures in order to limit the moisture content in the final turbine stages, but at Twin Branch the figure of 6.5 per cent. (approximating to marine practice) is only about half the accepted maximum for generating stations and should lessen blade erosion.

The British station most nearly comparable is Brimsdown A, which works at 2,000 lb. per sq. in. but has forced-circulation Loeffler boilers. Some two-and-a-half years ago, before generation statistics in this country became involved in the blackout, a thermal efficiency of close on 30 per cent. was attained in preliminary runs.

From an editorial in *Power* we gather that no "teething troubles" at Twin Branch have been due to high pressure as such. The most serious of these appears to lie in the control of superheat and reheat temperatures arising out of the adherence of slag to heating surfaces. This has entailed running at some 80 deg. F. below the designed initial temperature pending

rearrangement of these surfaces. The power company claims that the scheme has proved the commercial and technical feasibility of operating 2,400-lb. natural-circulation boilers and 2,300-lb. turbines. Regarding the former, particulars of capital expenditure and cost of coal per ton are not yet available, but from the performance of the station to date the technical case seems likely to be substantiated.

Telecommunications

LONG-DISTANCE telephony is so much a matter for international agreement that notable developments are not likely in current circumstances—or, if they do occur, they may not, perhaps, be publicly discussed. Nevertheless, it is as well to use the opportunity provided by the static conditions prevailing to take stock of the present position, as was done by Dr. W. G. Radley and Mr. E. P. G. Wright in their I.E.E. paper last week. The comprehensive comparative survey of various methods thus made available should be borne in mind as a reference source when normal engineering progress can be resumed.

Absolute Units

BUT for the war, the M.K.S. or Giorgi system of electro-magnetic units would have become the international legal standard of measurement. Yet little appears to be known about it in general engineering circles, where difficulties are likely to arise owing to the previous use of the more cumbersome C.G.S. systems. On September 20th, 1940, we published an article explaining the fundamentals of the M.K.S. system and in this issue Professor R. O. Kapp shows the practical need for a thorough understanding of its principles, which are not so abstruse as is commonly supposed.

System Maintenance

ALTHOUGH freedom from breakdown of electrical plant was never so important as it is now, it becomes increasingly difficult to carry out regular maintenance schedules. Much may be done, however, with the aid of electrical measurements, as stated by Mr. C. W. Marshall in this issue. Most of these measurements are the by-products of researches that have been carried out over a number of years, and in this connection it is good to learn that hopes expressed by contributors to the discussion on Mr. J. S. Forrest's recent I.E.E. paper on porcelain insulators will be realised, as the intention of the Central Electricity Board is to continue its good work in this field.

Recovery from Shock

IT is now generally recognised that efforts towards resuscitation from electric shock should be started at once and prolonged until there is a clear indication of recovery or until medical authority has pronounced life to be extinct. It is perhaps not so widely realised that restoration to an apparently normal state is not enough. Recent investigations reported in *Electrical West* show the danger of relapse with fatal consequences if the patient does not rest afterwards. He should always lie down and keep warm until he has received medical attention. Unfortunately apparent recovery is often accompanied by a desire on the part of the victim to undertake physical exertions.

Sir D'Arcy Cooper

THE death of Sir Francis D'Arcy Cooper last week removed the man who was very largely responsible for the formation of the Export Groups of which so much was hoped. There is little doubt that these organisations had great potentialities, but their work was unfortunately neutralised by events subsequent to their establishment. But perhaps we have yet to see the benefits which they were designed to bring to this country by the rationalisation of its export trade. In the difficult post-war era they may prove of invaluable service.

Subsidising Electricity

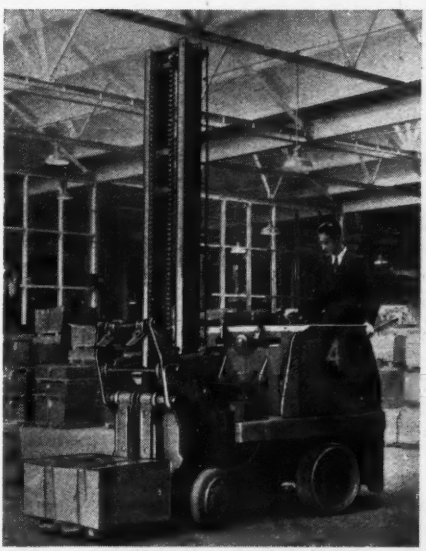
THE implementation of the Price Stabilisation Emergency Regulations in New Zealand, it appears, may result in subsidies being granted to supply authorities in order that prices shall remain at a fixed level, probably as at September 1st, 1941. If the Price Investigation Tribunal agrees to an increase, an appropriate subsidy would be granted and an order made restraining the electricity supply authority from raising its prices. This matter is of interest to electricity supply authorities here. Ever since Sir Kingsley Wood included electricity among the price-controlled commodities they have been wondering how they were to be compensated for any loss which they might sustain. But the matter has not yet seriously risen as a national problem.

Can Making

How Electrical Control Speeds Up Production

SEVERAL articles have appeared in the ELECTRICAL REVIEW recently bearing on the important subject of food storage. Following the account of work in a modern cannery in our issue of October 3rd, we are now able, through the courtesy of the Metal Box Co., Ltd., who permitted us to visit one of their factories, to describe the associated and complementary process of producing the necessary cans for containing the foodstuffs. Here, too, electricity is much in evidence, not only for providing all the motive power, but also for operating the complicated system of control and protection which is an essential feature of the process.

The raw material for the factory takes the form of sheets of prepared tinplate of various sizes and gauges or substances. These sheets arrive in "stillages" or batches of ten boxes, each of 112 sheets, a stillage thus containing 1,120 sheets. These weigh on an average one ton each and are unloaded two at a time from trains or lorries by means of five 2-ton Yale electric elevator trucks (operated by 30-V batteries) and stacked in a stockroom until required. The electric trucks are also employed for handling the sheets between the various processes of manufacture.



A two-ton Yale elevator truck used for transporting and stacking the sheets from which the cans are made

To give the cans additional protection (when required) against severe conditions, the sheets are first given a coat of lacquer. The plant employed for this purpose is most impressive. Each complete lacquering line is 152 ft. in length, while the 100 ft. long continuous drying ovens stand 8 ft. high.

The sheets of metal to be treated are placed on an incline, whence fingers on a moving chain conveyor belt carry them up through a slitting machine (driven by a 1-HP, 700-RPM Crompton Parkinson motor), which trims off the side edges of the plate to ensure that they are of a standard width. On leaving the slitter, the sheets are carried to a series of cleaning rolls, which, covered with a carpeting material, remove any dust that may have settled on them: a 2-HP 940-RPM motor drives this portion of the machine.

On the conveyor once again, the sheets pass over two magnetic rolls which grip them tightly on to the bed of the machine while they receive their coat of lacquer from a gelatine roller of much the same type as is used in printing. The magnets, together with guides, ensure that the plates are always in the correct place in relation to the lacquer rollers. This is important since the lacquer is not applied all over the plate, but portions of it are left untreated at distances corresponding to the dimensions of the cans. The reason for this is that after the body forming process the lacquer would interfere with subsequent soldering operations. Actuating the magnets is a 110-V, DC supply from a 5½-HP, Crompton Parkinson motor-generator which also supplies the necessary "safe" current for operating the various systems of control to be found throughout manufacture. This motor - generator itself has, of course, its own control equipment, a compact British Central Electrical Co.'s board.

As they come from the lacquer rollers the plates are fed on to the oven conveyor which supports them while they are passing through the dryer, a process which takes about 20 minutes. The oven, a "Chal" equipment made by Controlled Heat & Air, Ltd., comprises three distinct heat circulating systems. In the first stage the temperature is raised gradually, a fan driven by a 12½-HP, 940-RPM motor drawing the heat from the gas

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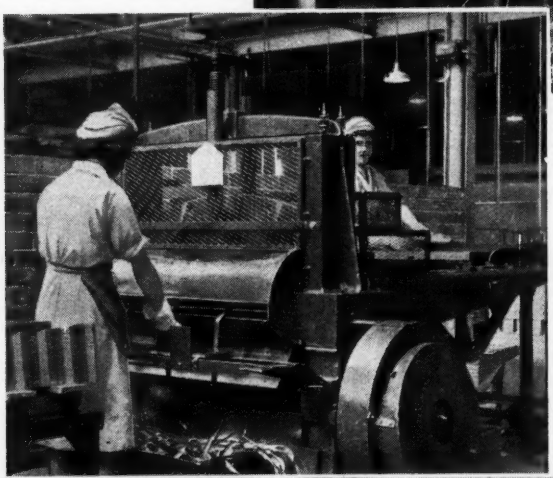
chamber and circulating it round the interior of the oven. A 2-HP, 1,400-RPM motor operates a small extract fan at the top of the oven to remove the fumes. In the second and third stages the temperature is maintained constant at about 375 deg. F., the motors employed for the heat circulation here being of 2-HP, 940-RPM. A check on the temperature is obtained by means of Cambridge indicators, while as a precaution against the failure of the electricity



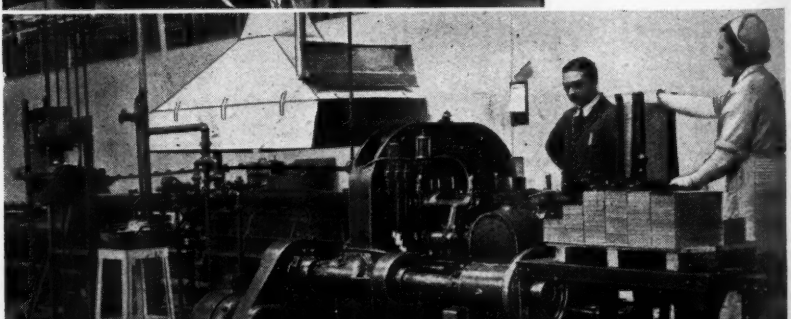
Above: Removal and inspection of sheets as they leave the lacquering oven.

Left: Scroll shears

supply an automatic device cuts off the gas.

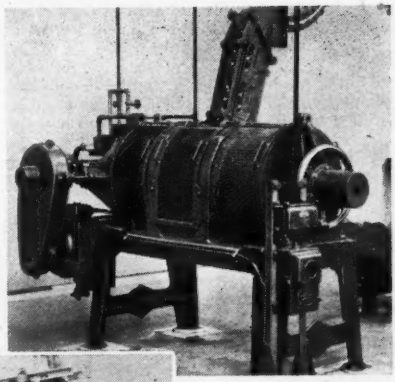
When the drying process is complete the plates are rapidly cooled off in order to make them fit for immediate handling. For this purpose three Keith Blackman fans driven by 1½-HP, 1,380-RPM motors are

The can line, where the bodies of the cans are made

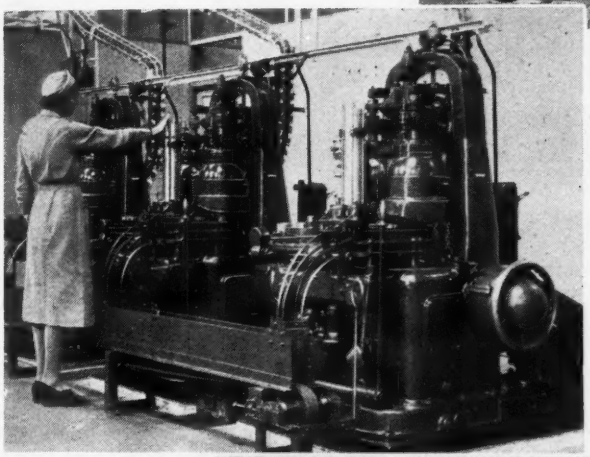


brought into service. These motors, incidentally, are controlled by Igranic across-the-line contactor starters, nearly all the other starters used from the works being of Donovan manufacture. The first of the three fans draws its air straight from the factory atmosphere, while the other two are fed from ducts leading out of the roof. To drive the conveyor right through from the lacquering machine to the end of the dryer, there is a 5-HP, 940-RPM, squirrel-cage induction motor.

The need for securing a smooth flow of sheets along the lengthy lacquering line and also for the immediate stopping of machinery in the event of a "jam-up" has made it essential to provide facilities for control and communication at all stages of the process.



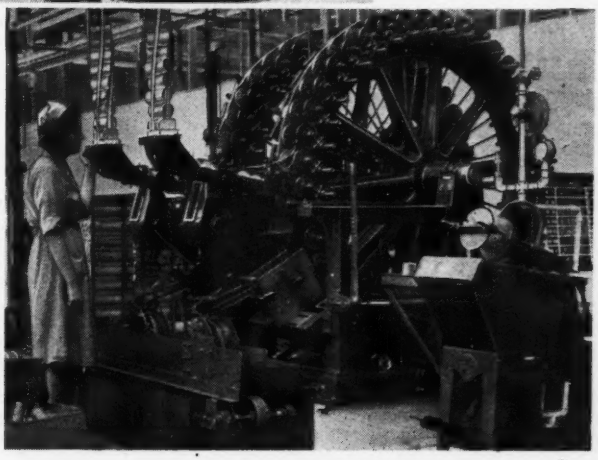
Body flanging machine



Above: Seaming machines which fit and seal the ends.
Right: Testing the cans

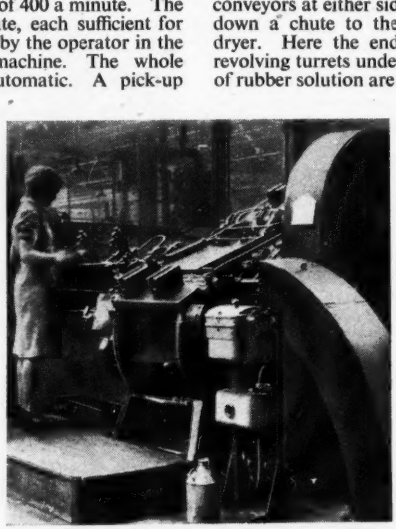
Lever-operated clutches worked through air cylinders stop the conveyors feeding the slitting, cleaning and lacquering machines, without stopping the motors, this arrangement saving a considerable amount of time in starting up again. Similarly, the operators removing and inspecting the plates as they leave the dryer are able, in an emergency, not only to stop the conveyor passing through the dryer (by means of an Ellison stop button), but also to press a bell-push to inform the operators at the other end of the machine.

The initial process in the actual forming of the cans is the making of the ends. For these, sheets go first to scroll shears of the guillotine type, where the sheets are cut into strips in such a way as to get the maximum number of ends out of a sheet. Stopping and starting



of the machine are effected either by manually operated clutches on each side, or by means of a push button controlling the 5-HP, 760-RPM motor.

Double die presses, each stamp the ends out two at a time at the rate of 400 a minute. The scrolled sheets of tinplate, each sufficient for several ends, are placed by the operator in the "magazine" of the machine. The whole process thereafter is automatic. A pick-up arm, fitted with suction rubbers, takes each of the strips and feeds them automatically between the cutting tools. The necessary suction is provided by a vacuum plant comprising two Ingersoll-Rand pumps (15-HP, 1,440-RPM motors with Ellison starters) operating in duplicate. The vacuum is created in the normal way in a tank, pipes being led off to the different machines.



A double die press for stamping out the ends

Air cushion devices on some of the presses are served by two 70 lb. per sq. in. Reavell & Co. compressors driven by 7½-HP, 1,440-RPM motors equipped with star-delta starters.

After being stamped out the ends drop down a chute and pass round "curlers," wheels which curl the edges ready for feeding to the solution applying machines and subsequent seaming machines. The scrap metal is extracted and sent down another chute which leads to the basement of the building where a system of conveyors driven by 3- and 4-HP, 940-RPM motors collects it and eventually feeds it up to the railway siding for disposal.

A clutch system is also favoured for the control of the presses. Here a 12-V, solenoid-actuated device is employed, coming into operation automatically at several points when certain contacts are made. The clutch is, for example, thrown out if a double plate gets under the punch or if the waste jams. In addition if anything goes wrong with the ends after they leave the die the vacuum suction device is automatically put out of action.

Both the vacuum and clutch controls can, of course, be operated by push-buttons if the occasion should arise. As in the case of the other machines the motors of the presses are stopped only if there is actual danger to the machinery. One further precaution against breakdown is being provided in the latest presses by fitting them with 2-speed Verity motors (5-HP) which run at either 420 or 940 RPM: these enable the clutch to be engaged whilst the flywheel is revolving at the lower speed and so minimise the force of impact.

From the curlers the ends go up short conveyors at either side of the presses and then down a chute to the combination liner and dryer. Here the ends are fed by means of revolving turrets under nozzles from which jets of rubber solution are forced round the rims by means of compressed air. In order to cause this solution to set hard quickly, the ends then pass slowly through the dryer from which they come out at the top and fall down a spiral chute for inspection prior to going to the seaming machine. Two electric motors are required on this combination liner and dryer, one a 2-HP, 940-RPM unit driving the lining machine, and the other, a 1-HP, 2,900-RPM machine for operating the fan which circulates the heat round the dryer: these are fitted with Ellison starters.

For forming the can bodies the sheets of metal go first to slitter machines of similar general design to those employed for the initial process in the lacquering section. In this case, however, the sheets are first of all slit into strips to suit the diameter of the can and then cut again at right angles, thus giving rectangular blanks of metal of just the right size for the cylindrical portion of the cans.

The blanks are fed into the body-making machine where they are drawn down by suction one at a time for a finger bar to take them to the "rolling station." The next operation, notching and slitting, removes a small piece of metal from two corners and enables the short sides of the blanks to be folded. After hooking the folded edges of the two sides together to form a cylinder, the joint is hammered together, soldered, wiped clean and finally cooled rapidly.

From the body-maker the bodies go up on an elevator to a runway which extends the whole length of the body-making, seaming and testing departments and serves the purpose, not only of providing a reservoir between the body making, flanging, seaming and testing processes, but also furnishing the weight of flow necessary for the satisfactory operation of the latter processes. Solenoid actuated stopping and starting switches worked by pressure bars

fitted at intervals along the runways bring relays into operation in the event either of stoppages or shortages of cans at key points.

Flanging of tops and bottoms of the cans is done by a rotary flanger, which, like the body-making machine, has a capacity of about 300 cans a minute. Three double seamers, each with a capacity of just over 100 cans a minute, firmly attach an end to each body leaving, of course, the other end open for the canners to complete in their own sealing machines.

Testing of every can is done automatically by pumping in compressed air at a pressure of 6 lb. per sq. inch. The cans are then taken slowly for a complete revolution of the machine—this taking several seconds—and if the slightest pressure is lost a diaphragm box comes into operation and rejects the can into a receptacle beneath. Occasionally, individual tests are carried out by putting a can under water, piercing it, and then pumping air by means of a foot pump into it until the seams burst. More often than not the cans will withstand a pressure of over 60 lb. per sq. inch. The compressed air required for testing the cans and also for forcing in the rubber solution in the end lining machines comes from two 30 lb. per sq. inch Ingersoll-Rand compressors driven by 17½- and 27½-HP, 1,440-RPM motors respectively and equipped with Ellison auto-transformer starters.

With regard to the motive power used for the body-making line the main motor for the body former is a 7½-HP, 940 RPM unit, there also being a 3-HP, 2,900-RPM unit for the cooler fan. Ellison starters are provided in each case. The flanger has a 2-HP, 940-RPM motor while the three seamers each have a 5-HP, 940-RPM unit, a 1-HP 2,900-RPM machine driving the tester; all these last five motors have Donovan starters. Each of the four elevators which take the cans from the body former, the flanger, seamers and testers is worked by a 1-HP, 940-RPM motor, two geared units of 2-HP serving the cable drive which takes the cans from the tester to the warehouse. Here they are either packed into cartons or placed direct into railway trucks, each of which holds as many as 50,000 cans.

Nearly all the motors, numbering about 450 and ranging from 1 to 27½-HP, are of Crompton Parkinson manufacture. For power factor improvement extensive use is made of B.I.C. static condensers, of which no fewer than 50 have been installed. Nearly all the metalclad switch fuse gear is Simplex. The factory is lighted by "Thorlux" reflectors and has a Keith Blackman air heating and circulating system employing local fan heaters. Music is provided during working hours by means of loudspeaker equipment supplied by Telephone Rentals, Ltd.

The 400-V, three-phase AC supply from the substation is taken *via* two main 600-A Ellison oil circuit-breakers to the busbars. Local control is secured by six 300-A breakers for the power and a 100-A unit for the lighting. All the electrical work was carried out by the Metal Box Company's own electrical department.

Transport After the War

As an introduction to a discussion on post-war transport problems at a recent meeting of the Yorkshire Section of the Institute of Transport, Mr. W. Vane Morland, general manager and chief engineer of the Leeds City Transport Department, reviewed recent developments in this field. In the course of his address (reported in the *Passenger Transport Journal*) he said that a particularly notable achievement was the large scale modernisation of the surface facilities in Moscow and its environs, together with an entirely new underground electric railway modelled on the London system. Before coming to a final decision as to the precise constructional details and layout of the scheme, the Soviet authorities sent engineers to tour every country possessing anything in the shape of modern transport facilities. This included a survey of London and several of the larger cities of the United Kingdom, among them Leeds. The three transport commissioners who came were extremely interesting. Their one ambition was to provide the Soviet Union, and Moscow in particular, with the best transport system which engineering science could produce. He gathered that the Soviet Union provided the financial backing of this and other transport schemes, and that the State would content itself with charging a scale of fares within the means of the citizens.

In New York progress was still being made with the further development of the subway system. The scheme had to be financially backed by the State, as experience had shown that the capital charges could not be wholly recovered from the actual fares. It was estimated that the 5 cent flat fare journey cost the authorities 8 cents. During an inspection of the various state-subsidised schemes in New York and the Middle West he saw evidence of the growing practice of electrifying the first few miles of railways out of the cities, one of the objects being the creation of smokeless towns. In New York, for instance, electric locomotives now hauled all main-line long-distance trains well outside the city. He came back from this trip tremendously impressed with the important schemes made possible with the assistance of the national funds.

In the following year he was able to see how Italy had gone ahead with state-owned electrification of the railways and a general modernisation of surface transport facilities in various cities.

It was useless to suggest that many large cities could hope to deal efficiently with a substantial proportion of their traffic above ground. Would the nation's purse, which incidentally was partially filled from taxation derived from the vehicles crowding their highways, be invoked to enable the great mass of these people to be moved safely and speedily, free from the restrictions which the present out-moded system imposed?

PERSONAL and SOCIAL

News of Men and Women of the Industry

IN our last issue we reported the appointment of **Mr. Hugh Boyd,** F.C.A., as Controller of the Belfast electricity undertaking and also the appointment of **Mr. G. F. Kennedy,** of Kennedy & Donkin, as consultant. Mr. Boyd is associated with Atkinson & Boyd, chartered accountants, of Belfast, and his professional duties have long brought him into intimate contact with every branch of the electrical industry. He was president of the Irish Institute of Chartered Accountants from 1935 to 1937 and is past chairman of the Belfast Society of Chartered Accountants.

Mr. Kennedy became assistant engineer with Kennedy & Donkin in 1932 and was engaged on checking power designs for the South Scottish grid and the preparation of schemes and of bills of quantities for 33,000-V transmission lines and 400-V distribution systems. In 1935 he became a partner in Kennedy & Donkin and for the next three years was resident engineer in Northern Ireland for the firm, supervising contracts for the Electricity Board for Northern Ireland for 33,000-V transmission lines, 400-V distribution systems, etc. In 1937 he supervised contracts for the Central Electricity Board in the South-West England area, and was responsible for all contracts for switchgear and ancillary equipment placed by the C.E.B. under the National Pool of Emergency Spares. During the current year he has submitted reports to the Ministry of Commerce for Northern Ireland and has also supervised power station work in that country.

Mr. G. F. Kennedy

Mr. J. A. T. Barnes, borough electrical engineer, of Kendal, who retires at the end of this year, has been presented by the members of the Council with a fireside chair. Councillor Kirkham, in expressing appreciation of Mr. Barnes' services, mentioned that he was appointed engineer and manager of the borough in 1906, two years after going to Kendal. The Council has placed on record its appreciation of the services rendered by Mr. Barnes to the town.

Among the survivors of H.M.S. *Prince of Wales* is **Lieutenant J. Hodgson,** of Wallsend. His father was lost at sea about three months ago. Lieut. Hodgson was formerly with Messrs. Merz & McLellan, consulting electrical engineers, Newcastle. Before joining the Navy he was with a searchlight company of the Royal Northumberland Fusiliers.

Mr. L. H. McMichael has been elected a vice-president of the British Institution of Radio Engineers.

Mr. S. J. Russell, A.M.I.E.E., has been appointed district mains engineer for the West Midlands Joint Electricity Authority's Shropshire distribution scheme. Mr. Russell has been on the mains staff of the Authority since 1930, and has been construction engineer in the Western District since 1939.

Lieut.-Col. Sir John H. M. Greenly, K.C.M.G., C.B.E., has accepted a seat on the board of the Metropolitan Electric Supply Co., Ltd., and its subsidiary companies.

Mr. G. R. Thursfield, M.I.Mech.E., has been appointed managing director of the Sturtevant Engineering Co., Ltd., in succession to the late Mr. G. A. Mower.

Messrs. R. A. Smith and **H. A. Watkins,** electricians with the East Suffolk Electricity Distribution Co., have been awarded the British Empire Medal for brave conduct in civil defence.

The General Electric Co., Ltd., announces that **Dr. C. C. Paterson,** O.B.E., has joined the board of the company. Dr. Paterson was born in 1879 and was educated at Mill Hill School. After serving a four years' engineering shop apprenticeship he passed through Finsbury Technical College and Faraday House. The earlier part of his career, from 1901 to 1918, was at the National Physical Laboratory with Sir Richard Glazebrook, where he was principal assistant responsible for the electrotechnical and photometric departments.

He then joined the G.E.C. to establish and direct the research laboratories. Up to the beginning of the war the G.E.C. research organisation had grown to over 500 people. Dr. Paterson is a past president of the I.E.E., the Institute of Physics, the Illuminating Engineering Society and other bodies. He has served as a member of the Executive Committee of the National Physical Laboratory and is vice-president of the Royal Institution and of the Society of Arts. He has been chairman and member of departmental committees on technical subjects and is now a member of Lord Hankey's Engineering Advisory Committee. He is chairman of the Electrical Industry Committee of the British Standards Institution.

Dr. C. C. Paterson

Dr. Paterson's main personal contributions to science have been in the field of lighting and vision. He has been Faraday Lecturer of the I.E.E., Guthrie Lecturer of the Physical Society and Huxley Lecturer of Birmingham University. He received the D.Sc. (*honoris causa*) from Birmingham University in 1937.

Miss C. Haslett, C.B.E., went to America at the request of the Ministry of Information to speak at a "friendship dinner" in New York, and also to fulfil a number of engagements at the invitation of business and professional women of the U.S.A. One interesting function was a dinner to attend which Miss Haslett flew 1,000 miles, and which was addressed by Mr. Winant, the American Ambassador, speaking from London. Miss Haslett lunched at the White House with Mrs.

Roosevelt, who expressed great interest in the educational work of the Electrical Association for Women, and advocated a joint conference after the war of women from America and Great Britain. Some of Miss Haslett's most important engagements were discussions with Miss Frances Perkins, U.S.A. Secretary for Labour, and visits to industrial plant and aircraft factories. She has attended and addressed industrial conferences and met leading American labour officials.

Mr. D. H. Abbott, deputy manager of the Crewe Electricity Department, has been appointed borough electrical engineer of Todmorden in succession to the late Mr. J. E. Rawson.

Mr. F. B. Collard, contracts manager of Callender's Cable & Construction Co., Ltd., who is retiring at the end of this month, has been with the company for forty-six years. He has been responsible for many important underground cable contracts in towns all over the country and in Guernsey.

Mr. C. H. Frankland, A.M.I.E.E., has been appointed manager of the Underground Section of Callender's Contract Department as from January 1st next. He entered the company's service in 1910, and since June, 1929, has been engineer-in-charge of the London District and South of England area for contract work.

Major Stanley M. Mohr, O.B.E., M.C., M.I.E.E., managing director of the Micanite & Insulators Co., Ltd., and associate companies, has been re-elected chairman of the British Plastics Federation, and Mr. H. W. Graesser-Thomas, of Yorkshire Tar Distillers, Ltd., and managing director of H. W. Graesser-Thomas, Ltd., has been re-elected vice-chairman of the Federation.

Obituary

Mr. R. D. Bower.—We regret to hear of the death on active service with the R.A.F. of Mr. R. D. Bower, the youngest son of Sir Percival Bower, chairman of the Birmingham Electric Supply Committee. Before joining the R.A.F. Mr. Bower was training as an electrical engineer in the Birmingham undertaking.

Wills.—Mr. F. E. Spencer, borough electrical engineer, Birkenhead, left £6,702 with net personalty £5,607.

Mr. E. H. A. Richardson, managing director of Associated Electric Vehicle Manufacturers, Ltd., left £4,501, with net personalty £3,860.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Preserving Wood Poles

REGARDING Mr. Christopher Wade's comments in the ELECTRICAL REVIEW of December 12th, on my letter in an earlier issue, the treatment I suggested was for *unimpregnated* timber. This naturally implies that impregnation is the proper method, and all engineers interested in this matter are fully aware of the long life of timber which is thoroughly impregnated. Not only are some poles being used with little more than a coating of creosote but even those classed as impregnated are often very doubtfully so. Additional ground line protection for such poles should therefore be well worth while.

I agree that bandaging over a preservative and tarring over all would stop so-called ventilation, but I cannot see that when only some 1½ ft. of the pole would be so covered that this would produce decay. If this were to be so, one might ordinarily expect the deeply buried portion of a pole to rot first. Mr. W. Hill states in his letter that he has found that for protecting the pole at ground level, charring, followed by a coating of tar, gives good protection. The tar would in this case, if generously applied, surely also act as a seal and stop ventilation.

I would again suggest that, for ground-level protection, a coating of preservative covered by a bandage made of scrap material, followed by a good soaking with tar, is likely to prove very effective, and as it would take but little time to carry out the cost should be negligible. A number of engineers with much experience of overhead-line work have informed me that they consider the method will prove effective and they propose to try it.

Twickenham. R. D. REYNOLDS.

Engineers and National Service

YOUR correspondent Mr. H. Rose (ELECTRICAL REVIEW, November 14th) is not alone in his feelings regarding the alleged organisation for national service. The crux of the matter seems to be that the powers that be are trying to organise industry and commerce on Civil Service lines, where efficiency is judged by examinations passed (or crammed for) and the "old school tie." It would appear that Sir J. Wardlaw-Milne was correct in his strictures, voiced in the Commons' debate on man-power, when he said that the Central Register was a farce. He might have added that in the present national emergency it is also a criminal tragedy. From my experience of the Ministry of Labour it seems that this instrument is an attempt to "Sandhurst" industry.

In July, 1940, "engineers" were instructed by proclamation to forward details to the Central Register; having had thirty years' electrical experience I did the needful, but on December, 1940, was informed that I was not required for registration. I called at Queen Anne's Chambers to locate the "Mandarin" who decided this point but could only get to

two very decent fellows who, upon inquiry admitted they were Civil Servants without technical knowledge; the "higher up" remained in obscurity.

I was invited to again apply for registration on the Central Register or the Supplementary Register the assumption being that I wanted a job. As I only wished to place my experience at the Country's disposal I left the matter in abeyance as it would seem that thirty years' practical experience as working mechanic, maintenance electrician, foreman in charge of contracts and technical assistant to a supply authority is of no use in an engineers' war.

During the past twelve months I have been asked to call at the local Labour Exchange and at local works where I would be "considered" for a job which I didn't need and which I certainly would not accept. I, of course, ignored these invitations as I am egoistical enough to think that my practical experience supported by City & Guilds certificates, taken in 1915, are equal, if not superior, to a recently-passed University examination.

To such as myself the only result is a feeling of frustration and the resolve to let our Civil Service cum political brains get on with the job as best they can. But oh! the pity of it all.

Ilford A.H.G.

"Engineering—Unlimited"

UP to the moment of writing, Mr. Johnson's article in your issue of November 7th and Messrs. Marryat's and MacMahon's letters have dealt with one side of this controversial matter, and I am therefore tempted to submit another point of view.

Undoubtedly Mr. Marryat makes out a very good case for the maintenance contractor, but as I see it from my own experience his case is built up on the fallacy that maintenance is the only function of the works engineer, the chief engineer or the chief electrical engineer as the case may be. A progressive firm is constantly on the change to better work, to improvement in its commodities and to the development of new products. Any industrial engineer will know only too well in this development how he relies on past experience and past mistakes for the advice he can give to his management when the future steps are planned.

Let us see what would happen if centralised maintenance came into universal being. It would have the natural consequence of eliminating the few well-paid professional engineering maintenance posts available in industry, together with a large number of underpaid works engineers' posts. The very source, therefore, from which each concern is largely dependent upon its development would disappear.

I suggest that it would be very unwise for any firm unless it is pursuing a static policy of manufacture on a standard product with relatively simple electrical and mechanical equipment, to throw away the embryo of its future upon this insufficiently considered plan.

If, nationally, we intend to make headway after this war, I contend that exactly the opposite course should be pursued and that far greater importance should be attached to the maintenance departments, which have for so many years had to face the ill-founded criticism of being non-productive and, therefore, not entitled to more than a small share in the firm's prosperity.

There may be conditions in the present war where centralised maintenance will serve a useful purpose, but unless the managements of the diverse concerns who employ the centralised maintenance department can look upon it also as their consultant for future development, I fear that more will be lost than will ever be gained by such arrangements.

*Southwark, S.E.*17. F. S. NAYLOR,
Electrical Engineer & Manager.

"Facts and Wishes"

I NOTE with sorrow that in a paragraph under the above title in your issue of November 28th, you rebuke me for being "naughty" by breaking the "truce" and "making little of electric wash boilers" in an article contributed to the *Gas Times*. May I be permitted to point out that there are some errors in your statement? I was not attacking electrical wash boilers, but on the contrary drawing attention to the weakness of some existing gas heated types, as you have indicated in your reference to my "confession." If to do so is to show signs of wearing "rose-coloured blinkers," I must plead guilty. I have no doubt that in private, if not in the pages of the ELECTRICAL REVIEW, you would agree that electrical appliances can also be improved in some respects.

If you will re-read my notes you will find that the extract which you slightly mis-quote as evidence against me referred to the relatively expensive gas-heated electrically-*driven* washing *machines*, which incidentally I described as "nice things." This may possibly be one of those "inconvenient facts" which it is "fashionable to ignore," but nevertheless it is a fact. I made no comment whatsoever on electrically-*heated* wash *boilers*, for the simple reason that they did not come within the scope of my article. I believe I am reasonably well informed as to the numbers of electric wash boilers now in use, but my emotions on learning the figures could have no place in a technical article and can be of no interest to your readers.

I should like to add, however, that I, too, have no time for "the stock arguments used by gas (and electric) men when comparing gas and electric services," except when those arguments are technically correct and can be used to further the general welfare of the community as a whole.

*London, S.W.*1. "THERMAX."

Supply System Maintenance

Ready Aid Afforded by Electrical Measurements

By C. W. Marshall, B.Sc., M.I.E.E.

IT is at all times of extreme importance to be able to determine rationally when maintenance of supply equipment is required. There is a tendency to forget this fact even in normal times, when maintenance is done at uniform time intervals, but it becomes doubly important under present conditions in which the shortage of man-power renders it difficult, even impossible, to work to normal time schedules. Some alleviation of the situation may be obtained by making the best use of measuring technique to determine when maintenance becomes necessary.

One of the most striking instances of this is to be found in considering the question of cleaning insulators. There are many situations, particularly in industrial areas, near chemical works close to the sea, where surface deposits frequently accumulate on insulators to such an extent that flashover would be inevitable if a proper cleaning programme were not followed. The shortage of man-power available for cleaning is such that there is a temptation, and even a tendency, to use actual flashover as the criterion as to when cleaning will be done. With modern discriminative protective gear and circuit-breakers, this crude procedure may almost be justified, but the available alternatives are so simple and inexpensive that they deserve the closest attention from maintenance engineers.

The author, who is with the Central Electricity Board, discusses means of ensuring that high-voltage equipment is attended to in time to avert breakdowns, and eliminate excessive maintenance work

Use of Telephone-type Counters

For example, in outdoor installations, leakage-current surges can be recorded conveniently by means of telephone-type counters. A counter fitted to each type of insulator provides continuous indication of the state of the surfaces; *e.g.*, an indicator on one transformer sealing-bell porcelain, one circuit-breaker bushing porcelain, a post-insulator unit and a suspension-insulator unit, gives all the guidance necessary to ensure that cleaning will be done neither too frequently nor too seldom.

Alternatively, the condition of the surface can be shown continuously by fitting electrostatic voltmeters at the same locations. Even if leakage-current surge counters are fitted it is good practice to check voltage distribution periodically by means of portable electrostatic voltmeters, since an experienced observer can readily determine with good accuracy when it is becoming essential to clean the insulator surfaces.

Maintenance of enclosed fibrous insulation is seldom necessary, and the number of failures in practice is so small that there is adequate justification for relying on the protective equipment to clear such faults as do occur, and to face repairing the associated damage. In certain cases, however, it is practicable to make continuous or regular checks on the condition of the insulation by convenient methods. For example, high-voltage condenser bushings which are tapped to provide voltage supplies for instruments, or to allow injection of high-frequency currents to the power system, may be controlled by measurement of the tapping voltage, again electrostatically.

Experience has shown that one of the commonest weaknesses in such bushings is tracking caused by internal discharges. This gives rise to short-circuiting between the metallic-foil layers of the condenser, and causes voltage rise at the tapping point. The part of the condenser bushing between tapping point and earth is comparatively lightly stressed and is unlikely to give trouble in the early stages of discharge phenomena, but any difficulty in this section will be shown by decrease in the normal voltage.

This method of control has proved invaluable in an actual case of high-voltage condenser weakness on a high-voltage system. In this case, a considerable number of the bushings failed, but all weaknesses were discovered at an early stage and no complete breakdown of the dielectric occurred. The procedure should also be valuable in diagnosing tracking between condensers and weather sheds arising from ingress of moisture.

Early Troubles Avoided

In all matters relating to the above class of field test of insulation, tribute must be paid to the American pioneers Doble and Tebo, who were the first to devise convenient field methods of diagnosis and to apply these methods on a comprehensive scale. They were probably inspired by insulation failures in earlier days of high-voltage transmission. We have to a great extent missed such experience by coming into the high-voltage field at a much later date,

but even with the greatly improved design and construction of modern high-voltage insulators it is unquestionably sound policy to provide the small amount of equipment and personnel which is necessary to maintain a regular check on insulation condition.

Testing Insulating Oil

Insulating oil has, on the whole, been a satisfactory and stable product. It may, however, deteriorate in three major respects. The dielectric strength may be impaired by increase of moisture; sludging may occur; and the acid content may increase. The customary manner of determining the condition of the oil is to take samples from the apparatus in which it is used, and to measure the dielectric strength and acidity as laid down in the British Standard Specification for electrical oils. The presence of sludge is usually indicated in the course of detailed inspection of the apparatus.

Little change has taken place in oil testing methods for many years, and the only test not generally known or applied in this country is that of measuring the power factor of oil samples in a standard condenser cell by the wattmeter or Schering Bridge methods. Some consideration has been given to the use of water-sensitive samples of insulation for immersing in the oil in transformer tanks as a means of giving early warning of the possibility of the windings becoming damp. It is possible, however, that a more practical procedure will be to use the insulation resistance of the windings themselves as the criterion, and attention is drawn to the sensitive high voltage insulation measuring equipment which was described in the ELECTRICAL REVIEW of July 25th, 1941.

Circuit-breaker Contacts

So far only the dielectric circuit has been considered, as this is the part of all electrical systems which is most prone to failure and in which the consequences of failure are most serious. In the electric circuit practically the only source of trouble is circuit-breaker contacts. Even these seldom require maintenance, but it is desirable to have means of checking their condition without opening the circuit-breakers. This can readily be done by resistance measurements, using a DC supply, and there is much to be said for making the measurement by the parallel ammeter method rather than by the more customary millivolt-drop system.

Magnetic-circuit troubles are fortunately still more rare. Their diagnosis is sometimes possible by accurate measurements of the iron losses and magnetising currents which may reveal irregularities. The gas evolution method is, however, much the most sensitive, but this entails provision of special gas collecting apparatus as a permanent feature of the protective equipment.

Measurements of the noise emitted by electrical plant, such as transformers, is sometimes of service in detecting slackness of parts, and modern objective noise meters in conjunction with cathode-ray oscillographs can be used with advantage in such investigations. Similarly, the electro-magnetic field radiated from power lines provides an invaluable guide to the state of the insulation. Measurements of the radio field are usually made with the express purpose of diagnosing causes of interference with wireless reception, but they are potentially valuable in line maintenance, and deciding when insulators should be cleaned.

Measuring Short-circuit Forces

The short-circuit forces which are now so prevalent due to faults caused by enemy action are bound to increase the amount of maintenance required by power supply apparatus. This throws into strong relief the need for knowing accurately and rapidly the order of these forces. The best method of supplying this need is by permanent oscillograph equipment. The usual type of oscillograph which involves photographic recording is hardly suitable with the present shortage of skilled personnel, but the Masson "Perturbograph" which provides the records automatically, although to a lower degree of accuracy, is quite suitable. Diagnosis of faulty protective gear operation in particular is greatly facilitated.

A still simpler procedure is to use quick-response indicating ammeters and voltmeters giving records of the maximum current and minimum voltage on all circuits under fault conditions. The most valuable application of such instruments is in the instantaneous location of faults on overhead lines with consequent reduction in the amount of patrol work which is required.

Details of the methods of carrying out the insulation tests referred to in this article will be found in the following I.E.E. Papers:—"The Characteristics and Performance in Service of High-Voltage Porcelain Insulators," by J. S. Forrest and "Field Measurements of Insulation," by E. A. Burton, J. S. Forrest and T. R. Warren.

Radio Engineers

THE British Institution of Radio Engineers, of which Dr. C. C. Garrard is president, has arranged the following London meetings for the remainder of the session:—

January 10th: "Recent Developments in the Design and Application of the Cathode Ray Oscillograph," by Mr. W. Wilson. February 7th: "Transmitting Valves," by Mr. L. Grinstead. March 7th: "Harmonic Distortion in Audio-frequency Transformers," by Mr. N. Partridge. April 9th: "Wired Broadcasting," by Capt. P. P. Eckersley.

The South-Western Section is holding a meeting in February (date not yet decided) at which Mr. G. Wooldridge will read a paper on "Wave Guides."

Machine-Tool Motors

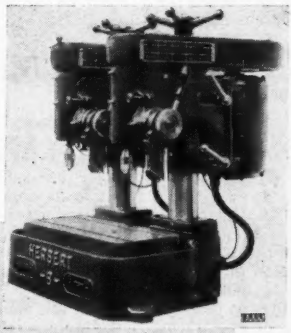
Choosing the Most Suitable Type

HIGH diversity factor in a present-day machine shop is to be attributed to the wide range of work that can be dealt with by general purpose machines. Mills and shapers, for example, are driven by motors of sufficient capacity to give the heaviest cuts and quickest feeds allowed by modern tool tips, so full load operation is seldom called for. No definite rules can be laid down for the horse-power needed by machine tools. Information required when selecting the driving motors, in addition to that relating to the system of supply, falls under the half-dozen heads discussed below.

The first is the type of enclosure, which depends almost entirely on the position of the motor on the tool. For some applications, *e.g.*, dry grinding, a totally enclosed dust-tight motor is desirable. Where the machine is exposed to mist from the coolant, *e.g.*, the work-head motor of a cylindrical grinder or the motor of a suds pump, drip-proof enclosure is unsuitable. The next point is mounting. Motors of the common horizontal-spindle foot-mounted type can be compactly housed in the base or column of the tool. Vertical-spindle spigot-mounting motors need to be protected from falling dust (rather than drips) by means of a cowl.

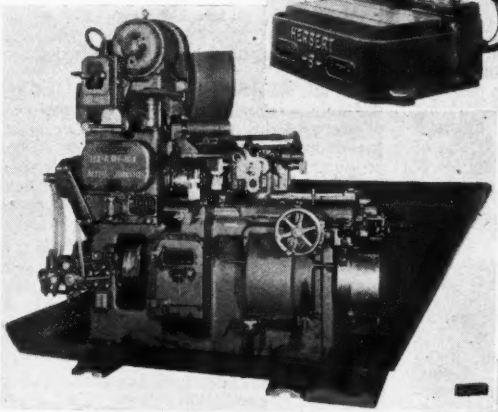
When the work need not have a high finish or is unlikely to be affected by slight vibration, the industrial AC motor with ball and roller bearings is normally employed. For precision grinders or any application in which the motor vibration must not exceed 0.0003 in., lubricated sleeve bearings are more suitable, and fans on ventilated motors should be dispensed with in order to secure the highest degree of balance.

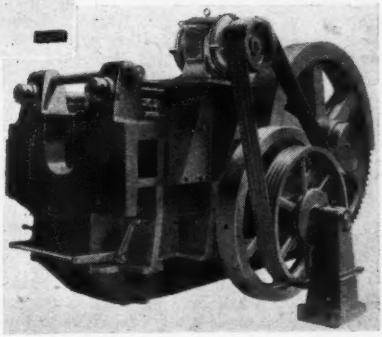
The starting torque of approximately one-third of the full-load value provided by standard squirrel-cage motors is suitable for most machine tools. Exceptions are those having a considerable amount of kinetic energy at full speed, *e.g.*, fly-wheel drives without clutches between motors and flywheels. In such cases improved starting performances for the motors are necessary.



1/3-HP 2,800-RPM foot-mounting motors on small bench drilling machine

Better - than - standard starting torque is also required of fast-traverse motors on table drives, such as milling machines, where a quick cycle of operations calls for rapid acceleration. Motors giving twice full-load torque at starting with direct switching or 66 per cent. torque when connected in star are available for such drives. For flywheel drives of the power-press type, current peaks can be smoothed by the use of "Hyslip" motors, which,





Above: 5-HP 1,430-RPM foot-mounting motor for automatic lathe. Right: 50-HP "Hyslip-Tork" motor on forging machine

normally giving a speed drop from no load to full load of 10 per cent., are available to give any required slip between 3 and 100 per cent.

For drives involving wide speed variation with close speed setting throughout the range, Ward-Leonard control is being increasingly employed. Another form of variable control comprises tapped transformer, multi-section rectifier and DC motor; in this the speed range is limited owing to the constant rectifier drop, which reaches a high proportion of the output voltage at very low motor speeds; also, a shunt regulator is required to give control between the transformer tappings.

The duty cycle of the motors driving any machine can often be varied over wide limits, so that the specifying of a large range of cycle times results in the use of a motor that is normally too large for its work. This applies also to reversing motors driving high-speed tapping machines, the rating of which is usually determined by the combined inertia of the tapping spindle and the motor rotor. The use of class B insulation permits a reduction in frame size and hence the inertia effects of the rotor.

Since the power demand depends also upon the kind of material machined, the type and condition of the cutting tools and their speeds and varying feeds employed, each case must be considered individually. Thus on two similar machines set up for different work, the correct motor ratings were 4 and 12 HP.

We are indebted to Crompton Parkinson, Ltd., for the information given in this article.

Production Engineers

LORD SEMPILL, A.F.C., was on December 13th, 1941, inducted as President of the JUNIOR INSTITUTION OF ENGINEERS by his predecessor, Viscount Falmouth.

In his presidential address Lord Sempill referred to his membership of the Institution for over a quarter of a century and pointed out that the most essential work of the Institution was contributing to the education of the men who must play a vital part in the making and controlling of the technical world of to-morrow.

He stressed the importance of engineering apprenticeship, and said that the practical experience of production thus gained was of great value in comparison with the commencement of an engineering education at a university where it was generally difficult to combine practical engineering training with the necessary academic instruction.

The whole of our engineering education, both in universities and in most technical colleges, needed reform to bring it into relation with the practical needs of to-day. Too much emphasis was laid on academic qualifications, and insufficient on the practical side of manufacture and economic organisation. A start had been made in this direction by the introduction this year of a Higher National Certificate in production engineering. The late Lord Austin had said that the need was for men who were 50 per cent. engineers and 50 per cent. organisers. That, he considered, was what a production engineer should be, and our educational system should be directed towards that end.

Lord Sempill acknowledged the work of the Loughborough College, Wolverhampton and Staffordshire Technical College, Acton Technical College, Northampton Polytechnic Institute and Birmingham Central Technical College, which had been pioneers in practical production training. Other educational centres with National Certificate courses had no bias on the practical production side, which he considered serious.

He urged that the Institution should lend its active support to modification of this position, and indicated that its members could render great service by undertaking lectures on jig and tool design, workshop organisation, industrial administration, time study and ratefixing and similar subjects.

Far too many young men of ability devoted themselves to design because of the possession of an engineering degree or National Certificate. Invention and design were fundamental, but production was of vital importance at present, and the new Higher National Certificate in production engineering would go far to change the attitude towards this "Cinderella" among engineering courses, and to provide the production engineers of the future.

Forthcoming Events

Institution of Electrical Engineers.—*Meter and Instrument Section.*—Friday, January 2nd, 5 p.m. London. Paper: "The Electrostatic Voltmeter as a DC/AC Transfer Instrument," by Mr. A. Felton.

Wireless Section.—Wednesday, January 7th, 5 p.m. London. Paper: "Aerial Characteristics," by Mr. N. Wells.

Transmission and Meter & Instrument Sections.—Wednesday, January 14th. London. Paper: "Measurement of Protective Gear on Power Supply Systems," by Messrs. Casson and F. H. Birch.

Western Centre.—Monday, January 12th, Royal Hotel, Cardiff. Wartime luncheon, followed by a discussion on "Electrical Supply Problems Arising from the War," to be opened by Mr. W. A. H. Parker. Tickets (6s. 6d. each) can be obtained from Mr. J. B. G. Lewis, hon. assistant secretary, Principality Buildings, Queen Street, Cardiff.

The M.K.S. System

Simplifying Electro-magnetic Measurement

By R. O. Kapp, B.Sc., M.I.E.E.
(Professor of Electrical Engineering, London University)

THE international M.K.S. system of electro-magnetic units first proposed by Giorgi in 1901 was adopted by the International Electrotechnical Commission in 1935. As the initial letters imply, it substitutes the meter, the kilogramme and the second as units of length, mass and time for the centimetre, the gramme and the second employed in the older C.G.S. systems. But this substitution is not its most important feature. The reason why the fifteen countries represented at the Scheveningen meeting of 1935 voted unanimously was not a preference for the larger over the smaller units, but a desire to make electro-magnetic calculations simpler and more mistake-proof and to make the teaching of fundamental principles less confusing to the student than it is at present. The M.K.S. system was adopted to meet a practical and not only a theoretical need.

Yet teachers and practical engineers will not be able to benefit from the change for some time to come. Most existing textbooks were written before 1935 and employ, therefore, the three troublesome C.G.S. systems. Our students must learn to understand these books as well as those written subsequently. So we have either to keep them in ignorance of this skeleton in the electrical engineer's cupboard or teach them four distinct systems of units. Practical engineers, too, cannot be expected to change their habits of thought as soon as a change is made in standardisation. So we are in a difficult transition period and we should do all we can to shorten it. But the length of the transition period must depend on the amount of attention which the subject receives, and both teachers and practical engineers have tended to ignore it. Perhaps it is not always realised that the M.K.S. system is both very necessary and quite easy to understand.

Professor Kapp deals with the confusion arising from the use of the three C.G.S. systems and in advocating the simpler Giorgi method considers means of shortening the transition period

The three systems of units already in use are the electro-magnetic, the electrostatic and the practical systems. They are different ways of measuring the same things like miles and kilometres. The units are given different names in the three systems. Those in the electro-magnetic system have the prefix "ab," those in the electrostatic system have the prefix "stat," and those in the practical system have no prefix. Thus there are an abvolt, a statvolt, and a volt. There are three different units of EMF. The volt is equal to 10^8 abvolts and $\frac{1}{300}$ statvolt. The ohm is equal to 10^9 abohms and $\frac{1}{9} \times 10^{-11}$ statohms. These and other conversion factors have to be remembered by the student or looked up in pocket books.

Prof. R. O. Kapp

Of course all calculations might be performed with the help of formulæ which give the answer in units belonging to one only of these three systems. One could then forget the other two. But this is not standard practice. The formulæ derived in the textbooks (at least in those written before 1935) give results in all three systems. The formula which is derived from first principles for the inductance of an overhead transmission line, for instance, gives the result of the calculation in abhenrys. The formula for calculation of the capacitance of the same line gives the result in statfarads. And one must use henrys and farads in the formula for calculation of the regulation of the line.

Why Three Systems?

One may well ask why three distinct systems with their enormous, cumbersome conversion factors ever came to be introduced and why all three were perpetuated for so long. The reason was a misapprehension, or rather two misapprehensions.

The first was the belief that the unit values of all measurable quantities in all branches of physics are determined when three independent units are defined arbitrarily. This is true for mechanics and the three arbitrary units selected in the C.G.S. system are the centimetre, the gramme and the second. When these have been defined one is not free to define any other unit arbitrarily. Unit force is automatically the dyne and unit work the erg.

But in electricity and magnetism three arbitrary units are not enough. If one defines only the units of length, mass and time, one is still free to give any value to the units of the electromagnetic quantities. A simple formula

will illustrate this. The force F exerted by a wire conveying a current I on a portion of a parallel wire of length l at a distance X in medium of permeability μ is given by the formula $F = 2\mu I/l^2X$. In the C.G.S. system F is in dynes, and we can define unit current as that which, when l/x is unity exerts a force of one dyne in a medium of unit permeability.

If unit permeability were to be determined by the definition of the three C.G.S. units, we should not be free to give it an arbitrary value. But those who devised the electro-magnetic system did give it an arbitrary value. They defined it as the permeability of a vacuum. Having done this they reached the value of unit current known as the abampere. Unit value for all other electro-magnetic quantities follows automatically.

Four Arbitrary Definitions

Thus was the electro-magnetic system of units constructed. It depends not on three but on four arbitrary definitions namely, unit length, unit mass, unit time, and unit permeability. The system is consistent and complete. This proves that four arbitrary units is the right number. If four were too many, unit permeability would be determined by the C.G.S. units and its independent and arbitrary determination would lead to inconsistencies just as it would lead to inconsistencies if we adopted the C.G.S. system in mechanics and then proceeded to define unit power as the horse-power.

If, on the other hand, four arbitrary units were too few the electro-magnetic system would be incomplete. We should still be free to give any arbitrary value to some electrical or magnetic quantities just as we should be free to give any value to mechanical force if we were to define the units of length and time only and leave unit mass undefined.

Consequently the electro-magnetic system is logical and scientific and would have proved quite suitable for all theoretical and practical purposes if it had been employed on all occasions. But, unfortunately, a fifth unit was also defined arbitrarily, and this led to inconsistencies. It happened inadvertently when scientists were seeking to define unit electric charge. They considered some such formula as $F = \frac{Q_1}{K}\frac{Q_2}{X_2}$ which expresses the force between two charges Q_1 and Q_2 at a distance X in a medium of permittivity K. Here one can define unit charge as that which exerts unit force on a like charge at unit distance in a medium of unit permittivity.

Now it can be shown that $\mu_0 K_0 = \frac{1}{9} \times 10^{-20}$ seconds squared per centimetre squared when μ_0 is the permeability and K_0 is the permittivity of a vacuum. From the definition of unit permeability already given, it follows that unit permeability is 9×10^{20} that of a vacuum. But this was not adopted. The permittivity of a vacuum was taken as the unit instead, a figure 9×10^{20} too small. Thus our forefathers defined the units of five quantities arbitrarily—one too many. Oddly enough they seem not to have noticed this. They thought they were defining only three. This is the second misapprehension of which I spoke above.

The only way to avoid inconsistencies was to allow two systems of units to exist side by side, each with four arbitrary units. In one of these the fourth was permeability. In the other it was permittivity. It then became necessary to invent a third system which would conceal the incompatibility between the other two. This is the practical system. In this two further units are defined arbitrarily, making seven in all. The extra two are the ampere and the volt. But this addition has not led to any further inconsistency as in the practical system the attempt to maintain consistency is largely abandoned. The relation between the units in this system is often obtained by the lavish use of conversion factors.

Three things must be done to get us out of the mess into which the two above-mentioned misconceptions have led us. The first is to get rid of the fifth arbitrary unit, the second is to get rid of conversion factors and the third to decide on the most suitable four fundamental units for purposes of dimensional analysis.

Securing Consistency

The first of these would be done if we were merely to drop the electrostatic system altogether. If we retained the C.G.S. electro-magnetic system in which unit permeability is defined as that of a vacuum we should have a perfectly consistent system. Whenever the permittivity of a vacuum occurred in a formula, as it does in all electrostatic calculations we should insert its proper value, namely, $\frac{1}{9} \times 10^{-20}$ units of permittivity. But there is an objection to this simple way out. All the units with which we are most familiar such as the ampere, the volt, the ohm would occur with large arbitrary factors. The formulæ would be clumsy and hard to remember.

So it is advisable to take the next step out of the wood. This was done by Giorgi. He noticed a fortunate coincidence. If the units of length, mass and time are defined as the metre, the kilogramme and the second, and if the unit of permeability is defined as 10^7, that of a vacuum, it so chances that all formulæ derived from first principles give the answer in amperes, volts, ohms and all the other practical units with which we are familiar. There are no conversion factors and only two arbitrary numbers have to be remembered. They are the permeability of a vacuum which is 10^{-7} M.K.S. units and the permittivity of a vacuum which is 1.113×10^{-10} M.K.S. units.

These two steps alone bring us to the Giorgi system. It is complete, consistent and ideally

simple. But, when these two steps have been taken, a third one suggests itself which has nothing to do with the M.K.S. system. We are led to consider which four fundamental units are the most convenient for purposes of dimensional analysis. For purposes of *measurement* all the units are defined in the Giorgi system. Any four can be chosen for the other purpose provided none of them is implied in the other.

There is no doubt about three of these. We have become so familiar with length, mass and time as the basis of dimensional analysis in mechanics that we naturally retain them in electricity and magnetism. But custom has not sanctified the fourth, and various suggestions have been made. Permeability has been used for the definition of unit quantities in both the electro-magnetic and the Giorgi system, but this is no reason why it should be used in dimensional analysis. And I have not seen it advocated for this purpose. Giorgi has proposed to use resistance as the fourth unit. Doherty and Keller in "Mathematics in Modern Engineering" have selected dielectric constant. Cullwick advocates charge and so do Frank and many others. The I.E.C. leaves the question undecided. But it is clear that a decision must be reached soon. All but one fourth unit will eventually have to be abandoned. And the more time we allow for several rivals to become established the more bitter will the inevitable battle of the fourth unit become.

Personally I think it probable that charge will be the victor, for the choice will, I hope, not be based on any extraneous theoretical considerations, but purely on considerations of convenience. Both resistance and dielectric constant lead to most awkward fractional exponents while there are no fractional exponents if charge is the fourth unit.

Meter Balance Tests

Their Significance and a Possible Alternative

By G. W. Stubbings, B.Sc., A.M.I.E.E.

REGULATIONS prescribed by the Electricity Commissioners under the 1936 Act require all polyphase meters to be tested for balance of the elements at unity and 0.5 power factors. Although the underlying idea of the balance test is not difficult to comprehend in general terms, the complete effect of imperfect balance on the performance of a meter in various conditions of three-phase loading is not generally understood. For the sake of simplicity, attention is here confined to two-element three-phase meters.

When the consumption in a three-phase circuit is measured by separate single-phase meters, the only condition to be satisfied for accurate measurement is complete accuracy of each of the meters considered as a single-phase instrument. That is to say, each of the meters with its associated instrument transformers, must be free from overall calibration and phase errors. There is no need for the gearing constants or the torque-per-watt characteristic constants to be the same.

Identical Characteristics

If, however, two single-phase meter elements are assembled to communicate torque to a common rotating system and are restrained by a braking torque produced by a common braking magnet, then, for accuracy in all conditions of three-phase loading, the torque-per-watt characteristics of the two elements must be identical. If this condition is not satisfied, then, although the meter can be adjusted to be accurate in one condition of three-phase loading, it will be inaccurate in all other conditions, *e.g.*, if adjusted for balanced load, unity power factor, when the element torques are nominally equal, it must be inaccurate not only with balanced load and power factors less than unity when the nominal element torques are unequal, but also, generally, with unbalanced loading.

Extreme Conditions

The regulation for balance testing stipulates that all voltage circuits are to be energised at marked voltage and that marked current is to be passed through each element singly in turn, other current circuits being idle. Balance tests are really checks of meter performance in extreme conditions of unbalanced three-phase loading, that is, with single-phase loading between red and yellow, and between blue and yellow lines.

The power factors which are stipulated for these tests refer to the power factors of the single-phase phantom test loads, so that, unlike the balanced load test, the red-element current and voltage are in phase with the unity power factor balance test of this element. The voltage circuits of both elements are energised normally because the voltage fluxes give rise to a small braking torque. The unity power factor balance tests check identity of the torque characteristics of the elements. The 0.5 power factor tests serve to check the freedom of the elements from individual phase error.

The desirability of the two balance tests,

one at unity and the other at 0.5 power factor, will be appreciated better if the effect of faulty element balance is explained. Let us assume first, that each element is free from phase error, but that the torque-per-watt characteristics are unlike. Suppose that the torque-per-watt in the blue element is the greater, then as the balanced load power factor falls from unity to zero, and as this element nominally contributes a larger and larger proportion of the total driving torque, the effect of the unbalance must increase. At zero power factor, when nominally the element torques are equal and opposite with balanced load, the blue element torque will predominate and there will be a creep such as would be set up by a phase error in a meter free from defective balance of the elements.

Equal and Opposite Phase Errors

It can be shown that if the excess torque per watt in one element has a percentage value of k, then this will give rise to a virtual phase error having a value in centiradians equal to $k/2\sqrt{3}$. Now consider another kind of faulty balance, that of equal and opposite phase errors in the two elements. With zero power factor balanced load a defect of this kind will not affect the equality of the element torques, so that there will be no creep. Equal and opposite phase errors in the elements do not therefore lead to a virtual phase error of the meter when considered as a three-phase meter.

Such errors as these give rise to a constant percentage effect on meter speed which is independent of the power factor, and if the algebraic phase-error difference is α centiradians, this difference produces a constant calibration error with three-phase balanced loading which is equal to $\alpha/\sqrt{3}$ per cent. This error can be compensated by adjustment, but this adjustment will make the meter inaccurate with single-phase loading.

The foregoing shows that the effect of defective element balance in three-phase meters is rather subtle, and that, whereas torque unbalance should theoretically be revealed by the balanced load 0.5 power factor tests if the elements are individually free from phase error, it is possible for the fictitious phase-error effect of torque unbalance to be compensated for by a real phase error, so that a meter inherently faulty can appear accurate by mere balanced load testing. Hence the balance tests that are officially stipulated by the Electricity Commissioners are justified.

Negligible Errors

The practical man may feel that all this is rather making a mountain out of a molehill, and that as total industrial power loads integrated by three-phase meters are generally approximately balanced, the service errors likely to occur in the registrations of a modern well-designed three-phase meter, proved to be accurate by a balanced load test at unity and 0.5 power factors, will be so small as to be negligible. This feeling is further justified by the consideration that small element-balance errors that are not revealed by the balanced-load test produce registration errors that vary according to the conditions of the unbalance of the load integrated, and that the diversity of these unbalance conditions over an accounting period may be such that the effect of faulty element balance is cancelled so that the effect on registration accuracy is negligible.

The considerable additional cost of the element balance checks certainly seems a somewhat high price to pay for the detection of faults which will, in the great majority of circumstances, have a barely appreciable effect on registration accuracy. It certainly seems possible that a simpler test could be devised, in which the balance of the elements is checked by absence of creep with nominally equal and opposing element torques, and that a cheaper and more rapid test of this kind might be a sufficient safeguard against the possibility of registration errors with unbalanced service loads that cannot be detected by the ordinary balanced load test.

Safety Torch

A HAND-TORCH designed for use in atmospheres which are inflammable due to the presence of vapours or coal dust, or in spraying booths, is specially suitable for aiding inspection work in aircraft factories and repair depots, to facilitate the tracing of petrol leaks from engines of damaged aeroplanes.

Aluminium torch for aircraft inspection

It is a product of the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, and its relatively small size makes it useful where ordinary flameproof handlamps cannot be employed. The torch (catalogue F.16556) is arranged to be operated from an intrinsically safe transformer, such as the XT.5620 of G.E.C. make. The case, which is of cast aluminium of zinc base, is fitted with a chromium-plated reflector and a SBC holder to accommodate a 6V lamp rated at 3 W.

The front glass is of the " armour plate " type and is protected by a steel grid. A gland is provided for the entry of a 23/.0076 three-core circular tough rubber sheathed cable of 250 V grade.

High-Pressure Steam

The New Twin Branch Station

By S. B. Jackson

A description of the plant and operating results at a new American station in which steam is raised at 2,400 lb. per sq. in. in a natural-circulation boiler

AN indication of the shape of things to come is given by the information now released referring to the extension of the Twin Branch (Indiana) Station of the American Gas & Electric Co. The new plant consists of one 550,000-lb. per hr. boiler designed for a pressure of 2,500 lb. per sq. in. supplying one 76,500-kW turbo-alternator. Pulverised-fuel firing and reheating are adopted in view of the boiler operating conditions envisaged and the otherwise probable wetness of the exhaust.

The boiler is of the natural circulation type and is operated at 2,400 lb. per sq. in. at the superheater outlet and a final temperature, after attemperator, of 975 deg. F. when reheating 450,000 lb. per hr. with an inlet temperature of 540 deg. F. to 900 deg. F. at 470 lb. per sq. in. The boiler consists of a primary furnace, first-pass, second-pass, main and by-pass convection section, economiser and air preheater. Attemperator (fine-spray desuperheater) control and motorised-damper reheat control are employed. The attemperator has a capacity sufficient to reduce the initial temperature from the superheater by 100 deg. F. The division wall between the second and last pass (convection section) continuing downward to form a hopper at the bottom of the second pass forms a reheat surface.

The entire unit is suspended, all expansion being downward. Four pulverising mills, each driven by a 100-HP, 600-RPM constant-speed motor, are supplied through feeders, and deliver fuel to eight burners. Oil burners having a steam capacity of 50,000 lb. per hr. are used for fuel ignition. The mill was specified to deal with coal having a calorific value of 10,000 to 10,400 BThU per lb. with an ash content of up to 18 per cent.

Primary air, 38,600 cu. ft. per min. at 25 in. w.g. to the four mills (20 per cent. of the total), is delivered by one fan, driven by a 200-HP, 1,250-RPM variable-speed motor, and is preheated from 125 to 400 deg. F. Secondary air, 153,000 cu. ft. per min. at 11.6 in., is supplied by one forced-draught fan driven by a 400-HP, 1,160-RPM constant-speed motor with vane control at 570 deg. F. Two induced-draught fans with a duty of 170,000 cu. ft. per min. at 17.8 in. at 365 deg. F. are driven by 750-HP, 870-RPM constant-speed motors also with vane control. The preheater surface is 133,500 sq. ft.

Molten slag flows into a primary hopper and is continuously agitated by water jets. A secondary ash pit at the bottom of the second pass below the reheater deals with either liquid or dry ash, final ash disposal being effected hydraulically to the receiving pit. A minimum ash-fusion temperature of 1,800 deg. F. is the design basis of the combustion space. Ordinary soot blowing practice is adopted, but telescopic blowers are on trial in the second pass.

Complete thermal-flow studies were made before designing the boiler and were supplemented by experimental components under the contemplated conditions. Experience has confirmed the expectation based on these investigations that natural circulation would prove satisfactory in practice. Measurements were made by pitot tubes installed in all steam generating circuits under operating conditions.

Foreign matter deposited during construction was removed by introducing 6.7 lb. of calgonite and 1.3 lb. of caustic soda in solution per 1,000 lb. of water. Prior to boiling out, the boiler was filled to the top of the drum with water treated with sodium sulphite and heated by hydrokineter to 200 deg. F. Water level was then lowered and the foregoing solution added. Over a period of eighteen hours with its pressure at 75 lb. per sq. in. the boiler was blown down intermittently thus progressively reducing the foreign solids. At 275 lb. per sq. in. in the superheater and high-pressure system, the boiler was blown to atmosphere and then drained.

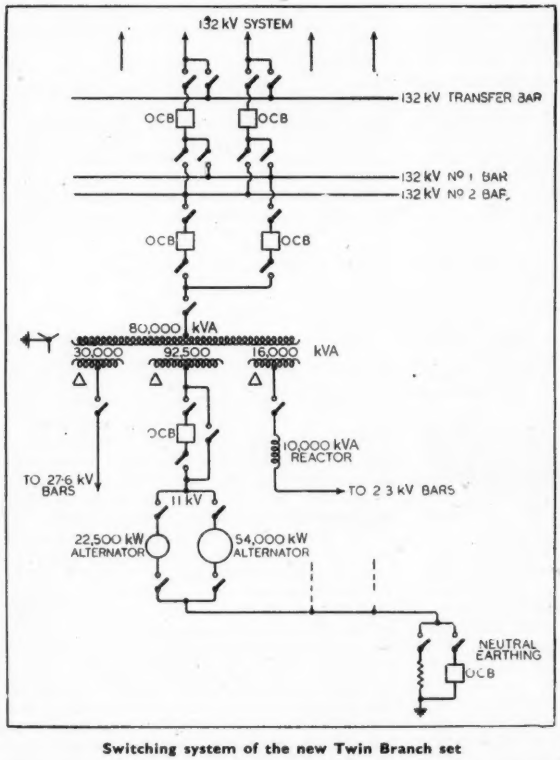
The limiting requirement of the starting-up procedure was that all temperature differences in the metal of the drum and the tubes should be controlled within 50 deg. F. Thermocouple recorders were employed, the readings being brought out on to a special panel. For raising pressure and putting on and taking off the line a special technique has been developed in association with the turbine. Continuous steam and condensate conductivity measurements are made in various parts of the cycle, the hydrogen values at which are recorded.

Certain slagging troubles due to the temperature unbalance of the heat absorbing areas necessitated the rearrangement of screen surface, introducing additional water-wall surface in front of the reheater division, altering the super-heater platens and fitting seven additional access doors in the second pass for better observation and cleaning.

Comprehensive boiler-feed and boiler-auxiliary control has been installed. Superheat control and a measure of combustion control are included, motor-operated dampers operated from the initiating equipment being employed.

Three eight-stage motor-driven centrifugal pumps, 2,500 HP at 3,600 RPM, each with a duty of 550,000 lb. per hr. at 350 deg. F. discharge at 3,000 lb. per sq. in. with a suction pressure of 700 lb. per sq. in. Ample reserve is evident and under the circumstances it may be considered justified, although with experience the need for such caution may be minimised. It is significant that the pumps are of the centrifugal type and it may be assumed that the economics of reciprocating pumps were not disregarded. As the pump shut-off pressure may exceed 3,200 lb. per sq. in., seamless steel tubing, 9.625 in. outside diameter and 1.25 in. thick, has been used. The electrically operated boiler-feed valves for working up to 3,200 lb. per sq. in. and 500 deg. F. are of the gate or tilting-disc type with by-passes. The make-up is about 1.5 per cent., but this may be reduced.

The range was designed for an allowable stress of 8,500 lb. per sq. in. at 975 deg. F., and on account of creep considerations carbon-molybdenum steel was used. The piping is 11.0 in. outside diameter by 3.1875 in. thick and is produced by turning and boring a solid forging. Carbon-molybdenum steel is used in the reheat piping which is 12.75 in. outside diameter and 0.5 in. thick. Welded joints are employed and a high degree of supervision of the welds is obtained by X-ray examination. There are no main steam valves between the boiler and the turbine except the turbine stop-valve. I am not aware of the measures that have been adopted to prevent carrying over water to the high-pressure turbine.



Switching system of the new Twin Branch set

Generating Plant

The turbine is a cross-compound unit. The high-pressure part of 22,500 kW at 3,600 RPM is supplied with steam at 2,300 lb. per sq. in. and 950 deg. F. and exhausts at 375 lb. per sq. in. and 510 deg. F. to the reheater, from which steam is delivered at 335 lb. per sq. in. and 900 deg. F. to the 54,000-kW, 1,800-RPM low-pressure machine. Six-stage regenerative extraction with two drain coolers and gland return takes 34 per cent. of the steam delivered to the turbine. The final exhaust pressure is 29.0 in. Hg., the wetness being stated as 6.5 per cent. giving a low-pressure turbine efficiency ratio of about 84 per cent. It would be of interest to speculate upon the reason for this low wetness, the permissible proportion in the United States being ordinarily 12 or 13 per cent.

The high-pressure turbine is of double-shell construction and has eighteen stages, extraction at the eleventh stage being between two portions of the inner shell, and at the fourteenth stage in a chamber between the inner and outer shells. The temperature of the outer shell is relatively low.

An internal piping system heats the inner shell and fixing bolts on starting up in order to reduce expansion and gives about 75 deg. F. cooling at full load so as to limit creep stresses. An intercepting valve in the resuperheater line between the reheater outlet and the low-pressure inlet prevents overspeed of the

low-pressure element on loss of load due to stored steam. The low-pressure element may be operated at the old station pressure of 600 lb. per sq. in. and 750 deg. F. and the corresponding valve acts as a governor valve when so operated, a stop valve being suitably arranged in this connection.

The low-pressure unit was installed in advance of the high-pressure unit, permitting its commercial operation from the older station pressure. Starting up from cold, the unit is brought up to a load of 60,000 kW at 2,300 lb. per sq. in. and 900 deg. F. in about eighteen hours, but this cycle is considered conservative and may be materially shortened with safety, subject to suitable operating starting up and shutting down techniques.

The alternators are hydrogen-cooled at 0.5 lb. per sq. in., both systems being connected to a common extraction equipment dealing with hydrogen in the sealing oil. Suitable rotor and stator thermometry is provided. The 11-kV alternators are switched direct on to the 132-kV busbars through a 92,500-kVA transformer and isolating switches. The transformer is exceptional, having four windings, one connected to the generators and a second to the 132-kV system, the other two windings supplying 30,000 kVA to a 27.6-kV system and 16,000 kVA to the works auxiliaries at 2.3 kV. Both sets are brought up to speed electrically in synchronism; the 11-kV generator interconnector switch is rated at 4,000 A.

Control of Building

THE Ministry of Works and Buildings has announced that under the revised Defence Regulation 56A, which comes into force on January 1st licences will be required for the carrying out of works of construction, reconstruction, alteration, demolition, repair (including war damage), maintenance of premises, decoration and re-decoration if the total cost of the work exceeds £100. The regulation is retrospective to the extent that the stated maximum will include the cost of any other such work carried out on the property concerned during the preceding twelve months unless that work has been the subject of a previous licence.

Generally, licences will be obtainable from the Regional Licensing Officers of the Ministry, but in the case of local or highway authorities and public utility undertakings authorisation must be obtained from the appropriate Government Department (in the case of electricity supply undertakings the Electricity Commission).

As we reported last week, the Director of the Electrical Contractors' Association has pointed out to his members that they are affected by the Regulation in that work for the purpose of providing light, heating or other services and maintenance work is covered.

Copies of "Notes for the Guidance of Applicants" may be obtained from the Regional Licensing Officers at any of the following centres: London, Edinburgh, Cardiff, Tunbridge Wells, Reading, Cambridge, Birmingham, Nottingham, Bristol, Leeds, Manchester and Newcastle.

The condenser is of the single-pass type with a cooling surface of 0.425 sq. ft. per kW compared with about 0.75 sq. ft. per kW in this country maintaining a vacuum of 29.0 in. Hg with cooling water at 56 deg. F. The tubes are 0.875 in. in diameter and 21 ft. in effective length, arranged as an inverted "U." Steam flows over the outside and over the tubes to the inner chamber, the air off-take being within the inverted U. Slanting steel plates cause the condensate to flow into troughs with holes in the bottom, the troughs being staggered in reference to each other, preliminary de-aeration of the condensate and residual vapours being effected before reaching a large condensate well at the bottom. The de-aerator proper is guaranteed to maintain a dissolved oxygen content to within 0.005 c.c. per litre.

The following performance data has been obtained for two periods:—

	May 12th to June 6th, 1941	June 24th to June 30th, 1941
No. of hours run ..	622.83	168
kWh generated ..	32,236,000	11,092,000
kWh sent out ..	30,093,000	10,385,900
Average generated kW	51,757	66,024
Works auxiliaries, kWh	2,143,000	706,100
Works auxiliaries, per cent. ..	6.65	6.8
Coal consumption, lb.	29,886,000	9,722,000
Oil consumption, gal.	2,570	—
Calorific value of coal, BThU per lb.	10,354	10,886
Lb. coal per kWh generated ..	0.927	0.876
Lb. coal per kWh sent out ..	0.993	0.936
BThU per kWh sent out ..	10,282	10,189
Thermal efficiency, per cent. ..	33.18	33.49

Missing Data

The point of output measurement is not specified and on account of the unusual transformer design it may be considered necessary to debit some of the transformer losses (on account of station auxiliaries) against the sent-out efficiency given. No data of the turbine terminal conditions have been reported, but it is stated that the performance is materially affected by the reduced primary temperature. It is not clear whether starting up and shutting down losses are included.

In an analysis I have made of the probable conditions for the second period, the initial temperature to the turbine is shown to be in the region of 925 deg. F. and the reheat temperature 900 deg. F. The boiler efficiency is not so high as might have been anticipated. As a result of operational and other improvements, it is not improbable that the overall thermal efficiency at the economic rating of the set will be about 34.25 per cent.

COMMERCE and INDUSTRY

Industrial Accident Prevention. State of Export Trade.

Waste Paper Disposal

THOSE of our readers who have responded to our appeal to get together all their unwanted paper for disposal for the many uses to which it can be put in the production of munitions of war may possibly have had difficulty in getting it collected, although there are now few areas without properly organised arrangements. If there are such cases we shall be glad to give our assistance upon hearing about them.

Waste paper collection can be made to pay for itself if carried out on a reasonable scale, *i.e.*, a minimum of one hundredweight. There are specified market rates for the various classes of paper, among the highest being those for newspapers and ledgers, account books, etc. As we have said before, readers need have no hesitation in getting rid of documents that may be regarded as confidential, for merchants will give guarantees as to handling and disposal.

Preventing Factory Accidents

The first training course for industrial accident prevention organisers arranged by the Royal Society for the Prevention of Accidents on behalf of the Factory Department of the Ministry of Labour and National Service was such a success that a second course of this nature is being held at Balliol College, Oxford, from January 2nd to 13th next.

The syllabus covers every aspect of industrial accident prevention and over twenty lecturers will take part. The trainees—numbering about 50, nominated by their employers—will be accommodated at the college, and this will enable the maximum amount of time to be given to intensive instruction. The programme and syllabus will be supplied on request from the Royal Society for the Prevention of Accidents, 52, Grosvenor Gardens, London, S.W.1, or 426, Strand, Cheltenham, Glos.

Engineering Wages Award

Reference was made last week to the flat rate increase of 5s. per week awarded by the National Arbitration Tribunal to workers in the engineering and shipbuilding industries. The awards Nos. 157, 158, 159 and 160 are in practically identical terms. Clause 3 in the engineering awards reads as follows:—

"The Tribunal have given careful consideration to the statements and submissions referred to above and also to the statements and submissions made in connection with the case between the same parties which was heard by the Tribunal in January, 1941. They have also given consideration, among other matters, to a comparison between the wage standards of this and other industries, both at the present time and in the period since the outbreak of war and over a period of years preceding the war; to the effect of the application to the industry, since the time of the previous award, of the provisions of an Essential Order; to the fact that the negotiating machinery of the industry can be and is being invoked for the purpose of adjusting anomalies which may arise as between the earnings of different classes of workers; and to the fact that changes in the amount of the so-called national bonus, which has existed since 1917, have been the agreed normal method of increasing or decreasing wage rates in this industry, and that such national bonus therefore stands on a different footing from bonuses in industry which have only come into being since the war and are related solely to changes arising out of the war."

American Copper Wire Prices

According to the *Electrical World* steps are being prepared by Washington defence agencies to force down the price of copper wire. Manufacturers will be given an opportunity of reducing prices voluntarily, but it is the intention of the Office of Price Administration to impose a maximum below the ruling prices if necessary. It is stated that current prices are from 20 to 30 per cent. higher than a year ago, but the manufacturers contend that, although copper has not risen above the 12-cent "voluntary" maximum, the increase has been justified by the rises in the cost of other materials entering into wire production—cotton, chemical ingredients, yarns, rubber, tin, etc.

The O.P.A.'s move is said to be part of a general programme for the stabilisation of copper prices in all fields.

Linesman's Fatal Fall

Sheriff Johnston, Dumfries, recently held an inquiry into the death of Robert Ross, electricity linesman, Kirkmahoe, who was employed by Callender's Cable and Construction Co., Ltd. Evidence was to the effect that Ross was engaged in fixing cradle wires to a pole about 30 ft. high in a field. He was using a safety belt which was round his body and attached to an insulator pin on the cross-member of the pole. The extension part of the safety belt broke near the point where it joined near Ross's body and he fell to the ground, a distance of about 30 ft. He was removed to the infirmary where he died the same day, death being due to rupture of the lung.

Latin-American Trade Position

In the course of his speech at last week's annual meeting of the Bank of London and South America the chairman (Lord Wardington) reviewed the trade situation in Latin America. He said that with the loss to the South American countries of their European markets they were faced with the problem of mounting export surpluses. In this respect, however, they had been assisted by a greatly increased demand from North America, a demand which had been intensified by the requirements of the United States' defence programme.

Moreover the threat of economic penetration by the Axis powers had led Washington to pursue a policy of ever closer politico-economic co-operation with the governments of South and Central America and Canada, too, had participated in the expansion of inter-American commercial relations.

Due primarily to the shortage of shipping, the concentration of British industries upon war work and the operation of the priority delivery system in the United States, there appeared to have been

a complete swing-round in conditions in the import markets of Latin-America during the past few months. In fact there was now a shortage of essential import goods, notably fuel and materials required for public utility companies, national manufacturing industries, etc. Broadly speaking, it appeared that South American importers were now willing to buy and able to obtain the necessary exchange cover for any goods that supplying countries could ship.

The foreign trade outlook of the United Kingdom was now decidedly obscure. The Government was compelled in the national interest to devote the whole of the country's resources to achieving victory, and as the war went on the calls upon supplies and man-power would make it increasingly difficult to maintain exports. It was true that all the other great industrial nations were similarly engaged in, or preparing for war, but export trade was so vital to this country that the task of reconstituting it after the war must not be made needlessly hard and the principle of legitimate competition in foreign markets must be preserved as far as was possible.

Evidence was not lacking that official circles in London and Washington had this question well in mind and were already studying the problem of post-war restoration of British export trade.

Aircraft Identification

A new and revised edition of the *Flight* Identification Chart of British Aircraft is now on sale. Grouped according to type (fighters, bombers, flying boats and advanced trainers), and with Fleet Air Arm aircraft marked "Fleet" in red, the perspective illustrations present a general air aspect of each aircraft. Excepting the trainers, these perspectives are accompanied by line drawings depicting side elevation, head-on and plan views. Particular characteristics also are mentioned in adjacent text. Twenty-six leading types of aircraft are included on the latest chart, which has in all nearly one hundred illustrations. Copies may be obtained from *Flight* offices, Dorset House, Stamford Street, S.E.1, price 1s. 3d. each (postage 6d. extra for single copies, 7d. up to three copies and 8d. up to six copies), and through booksellers and newsagents.

Wages in the Contracting Industry

In accordance with the Wages (War) Adjustment Agreement of November 24th, 1939, the National Joint Industrial Council for the Electrical Contracting Industry declares that the cost-of-living (war) addition of 18s. 4d. which by the declaration dated August 27th, 1941, operated as from the first pay-day in September, 1941, for the pay period covered by that day, shall also be payable as from and including August 14th to the end of the pay period prior to the pay week covered by the first pay-day in September.

Thus if the pay week covered by the first pay-day in September expired on September 2nd, the amount payable is 12s. 1d.; if it expired on September 3rd the amount is 13s. 4d.; September 4th, 14s. 5d., and September 5th, 15s. 6d.

Sunday Work

One of the conditions of registration of builders and civil engineering contractors is that Sunday work is not permitted except under certain special circumstances. The Ministry of Works and Buildings has announced that there will be certain relaxations of the Order to the extent that the employees of "registered" persons will be allowed to carry out work on the following Sundays: December 14th, December 21st, January 4th, January 18th and February 1st. This relaxation is coupled with a recommendation that work on the Saturdays preceding the Sundays enumerated shall cease at midday.

It is understood that the reason for the relaxation is to prevent any fall in production arising from the present short working days and to meet the situation which has arisen because of the impossibility of maintaining at all times the standard week of 47 hours.

Trade Announcement

On January 1st next Callender's Cable & Construction Co., Ltd., is opening a new sales office and stores at Finkle Street, Carlisle. The manager of this new branch will be Mr. G. H. Parker, formerly of Callender's Sheffield office.

New Catalogues and Lists

Hammans Industries, Ltd., 5, Regent Parade, Brighton Road, Sutton, Surrey.—Bulletin (H101) outlining the mechanical and physical properties of aluminium and its alloys, indicating how laminated materials may be substituted for making instrument cases and bases, solenoid coil cores, scales and dials, gear wheels, bearings, panels, etc.

Universal Engraving Co., Ltd., 317 Lee High Road, London, S.E.12.—Pamphlet indicating the wide variety of engraved nameplates and dials (Hammans) available in metal, glass, celluloid and laminated materials, plated with nickel, copper, chrome or silver, or coloured.

Londex, Ltd., 207, Anerley Road, London, S.E.20.—Leaflet (No. 94) dealing with their liquid level control system "Lectralevel," and also giving information regarding the new Londex flow remote indicator.

John Harper (Meehanite), Ltd., Albion Works, Willenhall.—Brochure dealing with Harper-Meehanite castings.

Calendars, Diaries, etc.

Erskine Heap & Co., Ltd., have sent us a neat diary in black leatherette, which includes, in addition to the usual diary information, considerable data of value to electrical engineers.

A picture entitled "Saving His Face," which portrays an unsuccessful sportsman buying his "bag," decorates the calendar (with sheets showing the current, preceding and following months) sent to us by Fitter & Poulton, Ltd.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following :—

RADYOT tumbler switches.

ELECTRICITY SUPPLY

Belfast's Protest. Southend Suspends Minimum Charge.

Belfast.—APPOINTMENT OF CONTROLLER OBJECTED TO.—Among the matters considered at a special meeting of the Belfast Corporation last week was the raising of a loan of £110,000 for additional plant for the power station. The Lord Mayor stated that this was the third time since September, 1939, that the Corporation had applied to the Ministry of Commerce for sanction to proceed with the extensions, but apparently the advisers of the Ministry did not appreciate the position.

The Electricity Committee had been charged with failing to fulfil its obligations but, said the Lord Mayor, he wished to refute that allegation; if the Minister of Commerce had shown as lively an interest in engineering as the Corporation had done the present position complained of by the Ministry would not have arisen. The Electricity Committee's recommendation was adopted.

At the same meeting strong protests were made against the appointment of a Controller of the Belfast undertaking and a notice of motion was tabled calling upon the Government to cancel the appointment. The motion was considered at a special meeting of the Electricity Committee on December 16th, and was passed by a majority of four votes to three.

SHELTER LIGHTING.—The City Council is to have electric lighting installed in approximately 650 public air-raid shelters.

Enfield.—REFUSAL TO INSTALL OIL HEATERS.—The Civil Defence Committee, which refused to install oil stoves in public air-raid shelters, has succeeded in obtaining the consent of the London Regional Commissioners to the provision of electric heaters. The Commissioners state that the Council must accept the risk of the heaters being put out of action by interference with the electricity supply, and also make their consent conditional on the necessary equipment being immediately available and the work being put in hand at once.

Hereford. — ELECTRICITY FINANCE. — On December 16th the City Council discussed a decision of the Finance Committee in favour of acceding to the request of the Shropshire, Worcestershire & Staffordshire Electric Power Co. that the Council should ask all remaining mortgagees on the electricity account to accept repayment of their loans on six months' notice. It was recommended that the attention of the company should be drawn to the undertaking given at the inquiry into the deed of transfer to change over from DC to AC in the centre of the city, and that it should be asked to effect the necessary change-over as soon as circumstances permitted. Further, that the city treasurer should be authorised to negotiate for the transfer to the Council's consolidated mortgages fund on suitable terms of such proportion of these loans as he deems necessary. Several members spoke strongly against acceding to the company's request, but the resolution was carried by eight votes to seven.

Ilford.—10 PER CENT. DISCOUNT.—It is reported that in view of the substantial profit on last year's working of the electricity undertaking a discount of 10 per cent. will be allowed next quarter on accounts that are paid within 21 days. For the present the 20 per cent. war addition to charges is to remain in operation.

Inverness.—HYDRO-ELECTRIC DEVELOPMENT.—It was disclosed at a recent meeting of the County Council that there is a divergence of views between Inverness and Aberdeen County Councils regarding hydro-electric development. Aberdeenshire wants electricity and does not mind where it comes from, while Inverness-shire wishes to reserve its hydro-electric power for its own use as far as possible.

Paisley.—PRICE REDUCTION.—At its last meeting the Council approved the reduction of the lighting flat rate from 4½d. to 4d. per kWh recommended by the Electricity Committee. The heating rate of ¾d. per kWh is unaltered.

Southend-on-Sea.—DISCONTINUATION OF MINIMUM CHARGE.—As it had been pointed out that consumers who endeavoured to comply with the Government's request to save electricity might be penalised by having to pay a minimum charge, the Town Council has decided to suspend this charge in respect of free hire installations, "B" flat rate for lighting and "F" slot meter rate for lighting. The cost to the Electricity Department will be about £1,000 per annum.

Overseas

Straits Settlements.—SUPPLY IN MALACCA.—On December 10th in the House of Commons Captain Gammans asked the Under Secretary of State for the Colonies what arrangements the Municipality of Malacca proposed to make for the supply of electricity to the town and settlement of Malacca when the contract of Malacca Electric Lighting, Ltd., expired in April, 1942. Mr. G. Hall said that the Governor of the Straits Settlements had reported to the Secretary of State that on the expiry of the company's licence the Municipal Commissioners of Malacca intended to substitute a municipal supply.

TRANSPORT

Cardiff.—HIRE OF TROLLEY-BUSES.—At a recent meeting of the Transport Committee the chief engineer reported that his inquiries as to the possibility of hiring trolley-buses from other undertakings had been fruitless, and that he was in communication with the Minister of Transport and the Associated Equipment Co., Ltd., upon the matter.

Newcastle-on-Tyne.—TRAMWAYS' FORTIETH YEAR.—The fortieth anniversary of the introduction of the electric tramway system at Newcastle-on-Tyne was reached on December 16th. Before the electric trams were decided upon by the City Council, horse-drawn trams were used by the Newcastle and Gosforth Tramways Co. The City Council obtained sanction to reconstruct and electrically equip the old tramways which covered 14½ miles and to build additional routes covering 21 miles. On April 19th, 1900 the first rail was laid in Pilgrim Street and the work was completed on December 16th, 1901. Traffic revenue has increased from £150,334 in 1903 to £797,738 this year, and the number of passengers carried has risen from 33½ million to 130 million.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Dictograph Telephones, Ltd.—Speaking at the company's annual meeting on December 16th, the chairman (Mr. P. V. Summer) said that in view of the many difficulties of the past year the results could be considered very satisfactory. The construction of new installations had been well maintained and the company was playing its part in the national effort, having regard to the importance of communication systems generally.

Referring to loud-speaker installations in factories, Mr. Summer said that the company's output was fully absorbed and they had as much work in hand as the present personnel could cope with. The company's subsidiary, Grampian Reproducers, Ltd., had had a successful year.

The report and accounts were adopted and the payment of an 8 per cent. dividend was approved.

The Compania Hispano Americana de Electricidad (Chade) reports a net profit for 1940–41 of 28,822,119 gold pesetas, as compared with 25,109,721 gold pesetas for the preceding year. The total dividend is 60 Argentine paper pesos on the shares of the "A," "B" and "C" series and of 12 Argentine paper pesos on the "D" and "E" shares. One-third of the dividends will be paid in cash and the balance of 40 pesos on the "A," "B" and "C" series and 8 pesos on the "D" and "E" series and will be distributed in 4 per cent. 19-year notes, repayable on January 1st, 1961.

The Electric Furnace Co., Ltd., has declared an interim dividend of 3¼ per cent. (against 3½ per cent.).

The Engineering & Lighting Equipment Co., Ltd., has announced an interim dividend of 4 per cent. (against 6 per cent.).

George Kent, Ltd., are maintaining their interim dividend at 3 per cent.

Telephone Rentals, Ltd., are paying an interim dividend of 4 per cent. (unchanged).

The Quebec Power Co. is again paying a quarterly dividend of 25 cents.

New Companies

Syd. Jones (Failsworth), Ltd.—Private company. Registered December 4th. Capital, £1,500. Objects: To carry on the business of manufacturers and repairers of, and dealers in, wireless and television sets and accessories, electrical fittings, gramophones, motor cars, refrigerators, vacuum cleaners, etc. Directors: S. Jones, "Rosslyn," Sandy Lane, Romiley, Ches. (permanent managing director) and two others. Registered office: 580x, Oldham Road, Failsworth, Manchester.

Etco, Ltd.—Private company. Registered November 29th. Capital, £1,000. Objects: To acquire the business carried on by E. T. Chambers, as "E.T.C.O." or otherwise, and to carry on the business of mechanical, electrical and wireless engineers, electricians, etc. Directors: E. T. Chambers, 24, Clarendon Street, Leamington Spa, and E. F. Tattersall, 32, Telford Avenue, Leamington Spa. Registered office: 130, Daventry Road, Coventry.

Epsem, Ltd.—Private company. Registered December 2nd. Capital, £100 in 100 shares of £1 each. Objects: To carry on the business of mechanical, electrical and general engineers, turners, tool makers, wire drawers, manufacturers of, and dealers in, electrical, scientific and wireless instruments, electric lamps and torches, etc. The subscribers are: A. D. Cooper, 102, Station Road, New Southgate, N.11; R. Prosser, 246, Sandycombe Road, Kew, clerk. Secretary: G. E. McCanlis.

S. C. S. Proprietary Co., Ltd.—Private company. Registered in Edinburgh December 8th. Capital, £1,500. Objects: To carry on the business of electrical engineers, electro and chromium platers, etc. Directors: R. C. Jack and A. Polson, both of 3, Charlotte Square, Edinburgh. Registered office: 196, Rose Street, Edinburgh.

Electromart, Ltd.—Private company. Registered December 11th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers i electrical goods and appliances, radio sets and accessories, gramophones, etc. Subscribers: H. Horowitz, 31, Vallance Road, E.1., and A. Kirschenbaum, 42, Bromehead Street, E.1. Registered office: 16/17, Devonshire Square, E.C.2.

Holborn Electrical Industries, Ltd.—Private company. Registered December 10th. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in radio receivers, electrical accumulators and batteries, wireless and electrical components and accessories, etc. Subscribers: C. A. Sampson, 81, Blenheim Road, North Harrow, and E. W. Charter, 11, St. Albans Avenue, E.6. Solicitor: H. G. Hazelgrove, 50, Pall Mall, S.W.1.

Companies' Returns

Statements of Capital

Campbeltown & Mid-Argyll Electric Supply Co., Ltd.—Capital, £50,000 in £1 shares. Return dated July 28th. All shares taken up. £50,000 paid. Mortgages and charges: Nil.

Boston & District Electric Supply Co., Ltd.—Capital, £210,000 in £1 shares. Return dated July 30th. 194,000 shares taken up. £194,000 paid. Mortgages and charges: Nil.

Mirrlees, Bickerton & Day, Ltd.—Capital, £600,000 in £1 shares (100,000 5½ per cent. cumulative preference and 500,000 ordinary). Return dated August 1st. 71,000 preference and 466,000 ordinary shares taken up. £302,500 paid. £234,500 considered as paid. Mortgages and charges: Nil.

British Electric Traction Co., Ltd.—Capital, £2,998,397 15s. in £712,744 5s. cumulative participating preference stock, £1,326,263 10s. non-cumulative preferred ordinary stock, £790,752 deferred ordinary stock and £168,638 in ordinary shares. Return dated July 4th. £2,829,759 15s.

stock taken up. £2,046,007 15s. paid. £783,752 considered as paid. Mortgages and charges: £1,639,572 12s. 1d.

Cable and Wireless (West Indies), Ltd.—Capital, £2,445,630 in 9,782,520 shares of 5s. each. Return dated July 10th. 800,000 shares taken up. £200,000 considered as paid. Mortgages and charges: Nil.

West African Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated July 11th. 23,109 shares taken up. £231,090 paid. Mortgages and charges: Nil.

Eastern & South African Telegraph Co., Ltd.—Capital, £600,000 in £10 shares. Return dated July 11th. All shares taken up. £600,000 paid. Mortgages and charges: Nil.

Parmeko, Ltd.—Capital, £15,000 in £1 shares (5,000 preference and 10,000 ordinary). Return dated August 28th, 1941. 4,500 preference and 8,500 ordinary shares taken up. £8,750 paid. £4,250 considered as paid. Mortgages and charges: £1,715 17s. 5d.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Capital, £4,000,000 in ordinary stock. Return dated July 11th. All stock issued and fully paid up. Mortgages and charges: £752,400.

Electric and General Investment Co., Ltd.—Capital, £201,500 in £60,000 ordinary stock and 141,500 ordinary shares of £1 each. Return dated July 14th. £60,000 ordinary stock taken up. £22,000 paid. £38,000 considered as paid. Mortgages and charges: £91,640.

Victor Electrical Co., Ltd.—Capital, £1,000 in 1,000 shares of £1 each. Return dated July 26th. 800 shares taken up. £800 considered as paid. Mortgages and charges: Nil.

Veritys, Ltd.—Capital, £196,000 in £180,000 ordinary stock (in units of 5s.) and 64,000 ordinary shares of 5s. each. Return dated August 1st. £180,000 stock taken up. £190,150 paid (including 6d. premium on 546,000 units). £3,500 considered as paid on 14,000 units. Mortgages and charges: Nil.

Dowsing Co. (Electrical Manufacturers), Ltd.—Capital, £15,000 in £1 shares. Return dated August 7th. 12,557 shares taken up. £11,051 paid. £1,500 considered as paid. Mortgages and charges: £3,300.

Christy Bros. & Co., Ltd.—Capital, £225,000 in £75,000 preference stock and £150,000 ordinary stock. Return dated August 8th. All stock taken up. £176,083 paid. £48,917 considered as paid. Mortgages and charges: Nil.

Bostock & Bramley, Ltd.—Capital, £10,000 in £1 shares. Return dated July 31st. 8,950 shares taken up. £5,552 paid. £3,398 considered as paid. Mortgages and charges: Nil.

Arrow Electric Switches, Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated July 3rd. 4,000 shares taken up. £4,000 paid. Mortgages and charges: Nil.

Foster & Pullen, Ltd.—Capital, £5,000 in £1 shares. Return dated July 23rd. All shares taken up. £3,000 paid. £2,000 considered as paid. Mortgages and charges: Nil.

Montevideo Telephone Co., Ltd.—Capital, £220,000 in 220,000 shares of £1 each. Return dated July 28th, 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges: Nil.

S. Rogers & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 11th, 1940 (filed August 13th, 1941). 660 shares taken up. £660 paid. Mortgages and charges: Nil.

Greenwood & Batley, Ltd.—Capital, £600,000 in 140,000 preference, 354,585 ordinary and 105,415 unclassified shares all of £1. Return dated August 14th. 110,660 preference and 354,585 ordinary shares taken up. £201,312 paid (£1 on 69,340 preference and 121,430 ordinary, 6s. on 14,660 preference and 10s. on 12,520 ordinary shares. £247,515 considered as paid on the remainder. £26 calls unpaid. Mortgages and charges: £100,000.

General Electric Co., Ltd.—Capital, £9,600,000 in £1,800,000 6½ per cent. "A" preference stock, £1,800,000 7½ per cent. "B" preference stock, £4,198,392 ordinary stock and 1,801,608 ordinary shares of £1. Return dated August 14th. All stock issued and fully paid up. Mortgages and charges: Nil.

Mid-Lincolnshire Electric Supply Co., Ltd.—Capital, £700,000 in £1 shares. Return dated August 21st. All shares taken up. £595,000 paid. £105,000 considered as paid. Mortgages and charges: Nil.

W. T. Henley's Telegraph Works Co., Ltd.—Capital, £1,500,000 in £1,300,000 ordinary stock and £200,000 preference stock. Return dated September 5th. All stock issued. £612,480 paid on £413,080 ordinary and £199,400 preference stock. £887,520 considered as paid on £886,920 ordinary and £600 preference stock. Mortgages and charges: Nil.

Henley's (South Africa) Telegraph Works Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 22nd. All shares taken up. £2,000 paid. Mortgages and charges: Nil.

Electric Resistance Furnace Co., Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated September 24th. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Sphere Investment Trust, Ltd.—Capital, £1,400,000 in 600,000 6 per cent. cumulative preference and 600,000 ordinary shares of £1 and 200,000 unissued £1 shares. Return dated June 6th (filed September 11th). 600,000 preference and 600,000 ordinary shares taken up. £537,605 paid (£1 per share on 131,105 preference and 164,000 ordinary; £1 7s. on 100,000 preference shares; and £1 1s. 6d. on 100,000 ordinary shares). £704,895 considered as paid on the remainder. Mortgages and charges: £600,000.

Mortgages and Charges

Reliance Lift & Engineering Co., Ltd.—Satisfaction in full on or before January 5th, 1940, of second mortgage debenture dated August 31st, 1904, and registered September 12th, 1904, securing £100. (Notice filed December 9th, 1941.)

Liquidations

British Electrical Export Co., Ltd.—Winding up voluntarily. Liquidator, Jessie Turner, 63, Vincent Square, London, S.W.1.

John Baker & Son (Electrical), Ltd.—Particulars of claims by January 9th to the liquidator, Mr. B. G. Pocock, 3, Lauderdale Parade, Maida Vale, W.9.

STOCKS AND SHARES

TUESDAY EVENING.

JAPAN provides the dominating influence in the Stock Exchange markets at the present time. Heartening news from other battle-fronts is overshadowed by the developments in the Pacific and, more particularly, in Malaya. These have imposed a caution upon the previous activities of capital that had been seeking employment in stocks and shares. Securities in companies that are locally affected by the news from these areas have been depressed. For example, Perak Hydro-Electric have fallen 3s. 9d. to 11s. 3d., following upon their decline of last week. Tokyo Electrics, after their slump, are no more than a point lower at 13½.

The general trend of prices, instead of being uniformly upwards, as was the case two or three weeks ago, has turned in the opposite direction. Gilt-edged stocks have, however, escaped fairly well from the heavy tendency that has overhung most of the markets round the House, and the best-class industrial shares in companies situated within the United Kingdom continue to be well supported.

Electricity Supply

Amidst the mild depression which has overtaken a good many markets in the Stock Exchange, owing to the news from the Middle and the Far East, electricity supply shares hold their prices and maintain the steadiness that has characterised them for weeks past. Notwithstanding the restraint placed upon investment by the Malayan news, the ordinary shares of the electricity supply companies show scarcely any change. What little stock comes into the market is promptly absorbed by an investment appetite which gives but little indication of being dulled by the political situation abroad. In fact, the more uncertain the foreign position becomes, the more directly does investment centre its interest and its money upon shares of the best-class domestic undertakings. It is a matter for constant surprise amongst members of the Stock Exchange that these gilt-edged industrials should remain at prices at which the return on the money is less than 5 per cent. But the investor insists upon having them, and, as a result, the prices in this group offer a greater resistance to the prevailing feeling of caution than do most of those in other markets of the Stock Exchange.

Price Fluctuations

Home securities, it may be repeated, are more popular at the present time than are those with a foreign flavour. Central Electricity 3¼ per cent. stock of 1974/94 is a point higher at 98; the 4½ per cent. issue of 1951/73 has risen to 107. London Passenger Transport prior charge issues remain unchanged. The "C" stock, however, of more speculative type, has been changing hands below 40, although the nominal quotation is left unchanged at 41. Anglo-Portuguese Telephone shares are ⅛ lower at 15s. Cable and Wireless stocks show further falls and Marconi Marines at 27s. 6d. are ⅛ down. The recent support for Thomas Tilling shares has been partially withdrawn; the result is seen in a fall to 46s. 3d. Stocks and shares connected with India, Burma and the Malay States are mostly easier; the falls in Perak Hydro-Electric and Tokyo Electric sixes are mentioned above. The Home electricity group reflects the current predilection for domestic investments. City of London shares, for instance, are 6d. higher at 26s. 3d., and the shares of the Richmond Electric Company, a subsidiary of the County of London, at 23s. 9d., show a ⅛ advance. For preference shares the demand consistently continues. North Eastern sevens at 23s. have risen 6d. Shares in the same category are mostly a little better on the week.

Equipment and Manufacturing

A fall of 1/16 to 6s. 3d. in S. Smith 1s. shares is due to the reduction of the dividend from 50 per cent. to 37½ per cent. Johnson & Phillips have strengthened to 55s. 9d. Greenwood & Batley at 26s. 3d. are 6d. higher. In the heavy industries' shares, Babcock & Wilcox recovered their last week's decline and again stand at 45s. Vickers have gone back 6d. to 16s. 9d.

Ferranti preference shares recovered the dividend deduction, remaining at 26s. 3d., and Crompton Parkinson ordinary at 21s. 3d. x.d. are practically unchanged. It has become difficult to sell shares connected with the rubber industry, by reason, of course, of the apprehensions felt in regard to the vulnerability of rubber estates to attack by the Japanese.

Oriental Telephone

Oriental Telephone ordinary at 65s. have followed up their last week's fall of 7s. 6d. by a further drop of 5s., lowering the price to 3¼. The company has either sold, or is in negotiation for the sale of its Bombay, Madras and Bengal telephone holdings, but retains its interest in the Hong Kong Telephone Company, and it is to this last-named factor that the fall in the price of the shares is due. Earlier this month Oriental Telephones rose to nearly £4 on talk of a possible repayment of capital out of the proceeds of the sale of the Indian undertakings Nothing official followed this anticipation and apparently some of the more recent buyers considered it prudent to get out of their shares in view of the news and rumours from Hong Kong. On an unwilling market, the effect of such sales was disproportionate to the number of shares that changed hands.

(*Concluded on page* 751)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Dec. 23	Rise or Fall	Yield £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	53/9	..	4 12 9
British Power and Light	7	6	26/6	..	4 10 7
City of London	7½	7	26/3	+6d.	5 6 9
Clyde Valley	8	8	37/6	..	4 5 4
County of London	10½	8	35/–	..	4 11 5
Edmundson's:					
7% Pref.	7	7	32/6	..	4 6 2
Ord.	6	6	28/–	..	4 5 9
Elec. Dis. Yorkshire	9	9	42/–	..	4 5 9
Elec. Fin. and Securities	12½	12½	43/9	..	5 14 2
Elec. Supply Corporation	11½	10	43/9	..	4 11 4
Isle of Thanet	2	Nil	9/–	..	—
Lancs Light and Power	7½	7½	33/9	..	4 9 0
Llanelly Elec.	5½	5½	22/–	..	5 0 0
Lond. Assoc. Electric	5½	4½	19/6	..	4 12 4
London Electric	7	7	24/6	..	5 14 3
London Power Deb. Red.	5	5	104	..	4 16 2
Metropolitan	10	8	36/3	..	4 8 5
Midland Counties	8	8	37/6	..	4 5 4
Mid. Elec. Power	9	9	39/6	..	4 11 2
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	33/–	+6d.	4 4 10
Northampton	10	10	44/6	..	4 10 0
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	35/–	..	4 0 0
6% Pref.	6	6	30/–	..	4 0 0
Richmond Elec.	6	6	23/9	+⅛	5 1 1
Scottish Power	8	8	38/9	..	4 2 9
Southern Areas	5	5	18/3	..	5 9 7
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	20/–	..	4 10 0
Yorkshire Elec.	8	8	39/6	..	4 1 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	3/6	–3d.	—
Calcutta Elec.	8*	7*	35/6	–1/–	—
Cawnpore Elec.	10	10	30/–	..	6 13 4
East African Power	7	7	27/–	..	5 3 8
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/–)	7½	7½	12/–	..	6 5 0
Madras Elec.	6*	4*	22/6	..	3 11 1
Montreal Power	1½	1½	24½	..	6 2 5
Palestine Elec. "A"	Nil	Nil	20/9	..	—
Perak Hydro-elec.	6	7	11/3	–3/9	12 8 10
Shawinigan Power	83cts.	90cts.	13½	–1½	—
Tokyo Elec. 6%	6	6	13½	–1	—
Victoria Falls Power	15	15	80/–	..	3 15 0
Whitehall Inv. Pref.	7½	7½	15/–	..	10 0 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Dec. 23	Rise or Fall	Yield £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110	..	4 11* 1
1955–75	5	5	114	..	4 7 9
1951–73	4½	4½	107	+½	4 4 1
1963–93	3½	3½	101	..	3 9 4
1974–94	3¼	3¼	98	+1	3 6 4
London Elec. Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955–75	4½	4½	110	..	4 1 10
Lond. Pass. Trans.:					
A	4½	4½	116½	..	3 17 3
B	5	5	114½	..	4 7 4
C	1½	3	41	..	7 6 4
West Midlands J.E.A. 1948–68	5	5	109½	..	4 11 4
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	105½	..	5 13 9
Def.	1½	1½	24½	+1	6 2 5
Anglo-Portuguese	8	8	15/–	–⅛	10 13 4
Cable & Wireless:					
5½% Pref.	5½	5½	101½	–2	5 8 4
Ord.	4	4	65½	–1	6 2 4
Canadian Marconi $1	Nil	4cts.	5/6	–6d.	2 15 6
Globe Tel. & Tel.:					
Ord.	8½*	8½*	30/–	..	—
Pref.	6	6	28/9	..	4 3 4
Great Northern Tel.:					
(£10)	20	20	14½	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	7/6	–⅛	5 9 1
Oriental Tel. Ord.	11½*	16	65/–	–¼	4 18 6
Telephone Props.	6	6	10/–	..	12 0 0
Tele. Rentals (5/–)	10	10	8/9	..	5 14 3
Traction and Transport					
Anglo. Arg. Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc.	Nil	Nil	6½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	905	..	5 0 0
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	43/9	..	3 13 1
Brazil Traction	$1	50c.	11¼	..	—
Calcutta Trams	8	5½	22/6	..	4 17 9
Cape Elec. Trams	5	5	20/–	..	5 0 0
Lancs Transport	10	10	42/6	..	4 14 1
Mexican Light:					
1st Bonds	5	5	75	..	6 13 4
Rio 5% Bonds	5	5	92½	..	5 8 3
Southern Rly.:					
5% Prefd.	5	5	63½	..	7 17 6
5% Pref.	5	5	105½	..	4 15 9
T. Tilling	10	10	46/3	–⅛	4 6 6
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	39/6	..	5 1 3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Dec. 23	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron Elec. Ord. ..	Nil		7½	23/- ..	6 10 4
Assoc. Elec.:					
Ord.	10	10	43/9	..	4 16 3
Pref.	8	8	38/9xd	..	4 2 4
Automatic Tel. & El.	12½	12½	50/-	..	5 0 0
Babcock & Wilcox	11	11	45/-	+6d.	4 17 9
British Aluminium	12½	10	45/9	..	4 7 4
British Insul. Ord.	20	20	90/-	..	4 9 0
British Thermostat (5/-)	18½	18½	13/9	..	6 14 6
British Vac. Cleaner (5/-)	12½	10	12/6	..	4 0 0
Brush Ord. ..	Nil	Nil	4/6	..	—
Callender's ..	15	15	73/9	..	4 1 4
Chloride Elec.Storage	15	15	71/3	..	4 4 3
Consolidated Signal	17	17	80/-	..	4 5 0
Crabtree (10/-) ..	17½	17½	28/3	..	6 4 0
Crompton Parkinson Ord. (5/-) ..	30	20	21/3xd	..	4 14 1
E. K. Cole (5/-) ..	10	Nil	9/3	+3d.	—
E.M.I. (10/-) ..	Nil	6	13/9	..	4 7 3
Electric Construction	10½	10	34/6	..	5 16 0
Enfield Cable Ord.	16¼	12½	53/9	..	4 13 0
Elecl. Switchgear (10/-)	16	10	20/-	..	5 0 0
English Electric ..	10	10	37/6	..	5 6 8
Ensign Lamps (5/-)	25	25	15/-	..	8 6 8
Ericsson Tel. (5/-)..	25*	22*	40/-	..	2 15 0
Ever Ready (5/-) ..	40	40	30/-	..	6 13 4
Falk Stadelmann ..	7	7½	22/-	..	6 16 4
Ferranti Pref. ..	7	7	26/3xd	..	5 6 10
G.E.C.:					
Pref.	6½	6½	32/6	..	4 0 0
Ord.	20	17½	78/9	..	4 8 10
Greenwood & Batley	15	13	26/3	+6d.	9 18 2
Hall Telephone(10/-)	15	10	15/7½	..	6 8 0
Henley's (5/-) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	21/3	..	4 4 8
Hopkinsons ..	15	15	45/-	..	6 13 4
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion	32½	30	105/-	..	5 14 3
J. Lucas	15	15	65/-	−¼	4 12 4
Johnson & Phillips	15	15	55/9	+9d.	5 8 1
Lancashire Dynamo	20	20	65/-	..	6 3 1
Laurence, Scott (5/-)	15	15	11/-	..	6 16 4
London Elec. Wire	7½	7½	25/-	..	6 0 0
Mather & Platt ..	13½	10	41/3	..	4 14 1
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	90/-	..	4 9 0
Pye Deferred (5/-)..	25	25	13/9	..	9 1 10
Revo (10/-) ..	5	20	25/7½	..	7 16 0
Reyrolle	12½	12½	56/3	..	4 9 0
Siemens Ord. ..	7½	7½	25/-	..	6 0 0
Strand Elec. (5/-) ..	2	4	3/6	..	5 14 4
S. Smith (1/-) ..	50	37½	6/3	−¼	6 0 0
Switchgear & Cowans (5/-) ..	10	15	10/-	..	7 10 0
Tel.Condenser(10/-)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg.(5/-)	9	9	8/3	..	5 9 1
Tube Investments..	23½	20	87/-	..	4 12 0
Vactric (5/-) ..	4	Nil	3/6	..	—
Vickers (10/-) ..	10	10	16/9	−6d.	5 19 5
Ward & Goldstone (5/-)	20	20	16/6	..	6 1 3
Westinghouse Brake	17½	10	51/3	..	3 18
Walsall Conduits(4/-)	55	55	32/6	..	6 15 4
West, Allen (5/-) ..	7½	7½	5/-	..	7 10 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Concluded from page 749*)

Indian and Burma stocks are mostly easier. Calcutta Electrics at 35s. are half-a-crown down.

Telephone Properties

At the meeting of this company held on Tuesday this week, the statement made by the chairman, Sir Alexander Roger, went into detail to show how it was that the company was not only unable to pay any ordinary dividend for the past year, but would postpone payment of the dividend on the preference issue due on January 1st next. Putting it very briefly, taxation for the years 1940 and 1941 is estimated to amount to over £200,000. "Taxation," said Sir Alexander Roger, "of such crippling magnitude or the impossibility of imposing or collecting it from an independent foreign public utility company could never have been intended or foreseen by the draftsmen of the Act." The net result of the year's working is a loss of £15,400, against £37,000 profit in the previous twelvemonth. The dividend on the preference shares is cumulative, but, so far as can be foreseen, the difficulties rising from the onerous taxation will remain with the company for at least two years from now. The price of the ordinary shares is quoted somewhat nominally as being about 10s.

Atlas Electric

The affairs of the Atlas Electric Trust Co. are engaging a good deal of attention from the shareholders, and dissatisfaction exists amongst some of the proprietors who disagree with the policy hitherto adopted by the board. The Atlas Co. owns a large interest in a Montevideo railway company, and representations recently made to the board urge that it is essential for the company to have a Spanish-speaking manager who can act directly between the Uruguayan Government and the British board of directors. A meeting of the larger shareholders, more or less private in nature, was held early in this month. Objection has more recently been taken to this, on the ground that the smaller, as well as the larger, shareholder is entitled to hear the latest news concerning the company and its affairs. The 7 per cent. preference dividend has been regularly met, and the price of the shares stands at 21s. 6d., but the ordinary at 3s. 6d., although having risen about a shilling of late, must still be regarded as a gamble.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

1940

2109. "Electron-discharge devices suitable for ultra-short waves." Marconi's Wireless Telegraph Co., Ltd. February 2nd, 1939. (541477.)

3208. "Movement-magnifying mechanism, and electric switches, thermostats and other instruments incorporating said mechanism." P. W. Baker. February 20th, 1940. (541364.)

4297. "Welding rods and the manufacture thereof." Philips Lamps, Ltd. March 10th, 1939. (541446.)

7311. "Electro-acoustic devices." Standard Telephones & Cables, Ltd. May 19th, 1939. (541448.)

7441. "Cable motor ploughs and the like." A. Daniel. April 25th, 1940. (541482.)

8314. "Transformers." Akt.-Ges. Brown, Boveri & Cie. May 15th, 1939. (541485.)

8959. "Control of feed-water supply to boilers and generators." C. H. Armstrong, N. H. Brown, and Copes Regulators, Ltd. May 20th, 1940. (541449.)

9121. "Carrier-wave signalling systems." Standard Telephones & Cables, Ltd., F. C. Wright and S. E. Aldrick. May 23rd, 1940. (541373.)

9138. "Injection moulding machines for thermoplastic materials." T. H. & J. Daniels, Ltd., J. L. Daniels and A. O. R. Johnson. May 23rd, 1940. (5414377.)

9186. "High-frequency electron-discharge apparatus." Standard Telephones & Cables, Ltd., and R. N. Hall. May 24th, 1940. (541379.)

9187. "Electric transmission networks." Standard Telephones & Cables, Ltd., and C. N. Smyth. May 24th, 1940. (541380.)

9188. "Metal-to-glass seals." Standard Telephones & Cables, Ltd., and C. Strachey. May 24th, 1940. (541381.)

9190. "Printing-telegraph apparatus." Creed & Co., Ltd., and A. E. Thompson. May 24th, 1940. (Addition to 468839.) (541382.)

9229. "Automatic telephone systems." A. J. Stuart and F. A. Low. May 25th, 1940. (Cognate application, 156/41.) (541415.)

9304. "Electric-discharge apparatus." British Thomson-Houston Co., Ltd. May 27th, 1939. (541489.)

9305. "Electric direct-current inverting systems." British Thomson-Houston Co., Ltd. May 27th, 1939. (541490.)

9355. "Electron-discharge apparatus." Standard Telephones & Cables, Ltd., and W. T. Gibson. May 28th, 1940. (541529.)

9365. "Apparatus for comparing the relative intensities of sounds from two separate sources." Marconi's Wireless Telegraph Co., Ltd., P. R. Berkeley and A. G. Berkeley. May 28th, 1940. (541493.)

9368. "Methods of, and means for, producing high electrical potentials for cathode-ray television reproducers." Marconi's Wireless Telegraph Co., Ltd., R. J. Kemp and S. W. H. W. Falloon. May 28th, 1940. (541531.)

9373. "Monitoring arrangements for radio transmitters." Marconi's Wireless Telegraph Co., Ltd., F. C. Chamberlaine and D. Fairweather. May 28th, 1940. (541532.)

9470. "Generation and transmission of radio waves." Standard Telephones & Cables, Ltd. June 14th, 1939. (Cognate applications, 9471/40 and 9472/40.) (541535.)

9675. "Thermally operated electric control or relay devices." British Thomson-Houston Co., Ltd. June 1st, 1939. (Cognate application, 9676/40.) (541418.)

9680. "Electric protective arrangements." British Thomson-Houston Co., Ltd., H. Trencham and J. R. Mortlock. June 3rd, 1940. (541419.)

10373. "Stabilised oscillation generator." Standard Telephones & Cables, Ltd. June 16th, 1939. (541423.)

10418. "Steam generator stokers." Bennis Combustion, Ltd., and A. W. Bennis. June 15th, 1940. (541424.)

11057. "Directional aerial arrays." Marconi's Wireless Telegraph Co., Ltd. June 29th, 1939. (541427.)

11058. "Sideband and carrier transmitters." Marconi's Wireless Telegraph Co., Ltd. June 29th, 1939. (541428.)

11060. "Modulation limiters for radio and like transmitters." Marconi's Wireless Telegraph Co., Ltd. June 29th, 1939. (541495.)

11090. "Apparatus for gas analysis." British Thomson-Houston Co., Ltd. July 1st, 1939. (541386.)

11394. "Fluid blast electric circuit-breakers." British Thomson-Houston Co., Ltd. July 8th, 1939. (541496.)

12452. "Flame-cutting apparatus." General Electric Co., Ltd., and W. Schiff. August 1st, 1940. (541389.)

12495. "Electric dog-collar light." R. H. Ingleby. August 2nd, 1940. (541498.)

12521. "Push-pull valve amplifiers with negative feed back." General Electric Co., Ltd., and K. A. MacFadyen. August 2nd, 1940. (541391.)

13112. "Automatic control system for a carrier wave signal receiver." Hazeltine Corporation. September 13th, 1939. (541393.)

13397. "Carrier lead-in cable-leading systems." Standard Telephones & Cables, Ltd. December 13th, 1939. (541438.)

13651. "Refrigerators." British Thomson-Houston Co., Ltd. August 30th, 1939. (541453.)

14880. "Copper-clad wire, and methods of producing the same." National Standard Co., and A. H. Stevens (National Standard Co., in part). October 4th, 1940. (Addition to 534715.) (541396.)

15337. "Radio echo altimeters." Standard Telephones & Cables, Ltd. October 19th, 1939. (541399.)

15428. "Control of electric motors." F. Crowther, G. P. F. Newlands and Metropolitan-Vickers Electrical Co., Ltd. October 18th, 1940. (541503.)

15659. "Street lighting fittings." General Electric Co., Ltd., S. S. Beggs and H. J. Rouse. October 24th, 1940. (541505.)

16310. "Roller bearings." British Timken,

Ltd., A. W. Hill and R. Treen. November 11th, 1940. (541459.)

16627. "Automatic means for electrically starting internal combustion engines." J. V. Gil. November 18th, 1940. (541460.)

17840. "Device for protecting alternating current electrical apparatus against unbalance." Electrical Apparatus Co., Ltd., and R. H. Barbour. December 18th, 1940. (Addition to 531817.) (541541.)

18116. "Lamp sockets." Kodak, Ltd. (Eastman Kodak Co.). September 11th, 1940. (Divided out of 541454.) (541464.)

18194. "Electric protective devices." British Thomson-Houston Co., Ltd. December 29th, 1939. (541542.)

1941

1369. "Anti-friction bearings." B.T.H. Co., Ltd. February 1st, 1940. (541468.)

1608. "Apparatus for laying cables." A. Graham-Enock, H. W. Longville, and Graham-Enock Manufacturing Co., Ltd. February 6th, 1941. (541543.)

2917. "Bearings." Mallory Metallurgical Products, Ltd. May 8th, 1940. (541471.)

3670. "Devices for synchronising flashlamps with photographic shutters." Kodak, Ltd. (Eastman Kodak Co.). March 17th, 1941. (541472.)

4915. "Permanent magnets." Mond Nickel Co., Ltd. April 18th, 1940. (541474.)

13911. "Electric direct-current inverting systems." British Thomson-Houston Co., Ltd. May 27th, 1939. (Divided out of 541490.) (541516.)

Amended Specifications

521390. "Radiological apparatus." Schall & Son, Ltd., and another.

533113. "Telephone, etc., signalling systems." Siemens Bros. & Co., Ltd., and others.

534224. "Gas blast electric switches." C. H. Flurscheim and another.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—SYDNEY COUNTY COUNCIL.—January 29th. Steam and feed water piping for No. 10 turbo-alternator for the Bunnerong power station. Specification 559.

Birmingham.—January 14th. Salvage Department. Lead-plate batteries for electric refuse collection vehicles. (December 19th.)

Middlesbrough.—December 29th. Town Council. Electrical installations in trenches and installation of electric pumps. P. Kitchen, town clerk, Municipal Buildings.

South Africa.—DURBAN.—January 16th. City Council. Potential and current transformers. Contract E.2038. Electric cable and time switches. Contract E.2043.

BLOEMFONTEIN.—Municipality. January 15th. Six transformers, 15/1. Notice 73.

POST OFFICE DEPARTMENT.—March 26th. Automatic exchange equipment for Cambridge, East London. P.O. Tender 16.

Southport.—January 3rd. Corporation. Maintenance of two electric lifts at the new police headquarters. (December 12th.)

Orders Placed

Chester.—Electricity Committee. Accepted. Substation equipment (£22,804).—Metropolitan-Vickers Electrical Co., Ltd.

Durham.—County Education Committee. Accepted. Electrical installation at Broom Cottages Council School (£148).—R. Robson.

Middlesex.—Health Committee. Accepted. Electrical repairs at Springfield Hospital (£250).—Colston Electrical Co., Ltd.

New Zealand.—PUBLIC WORKS DEPARTMENT.—Palmerston North: Protective relays.—Metropolitan-Vickers Electrical Co., Ltd. Central relay and instrument board.—Asea Electric (N.Z.), Ltd.

Tynemouth.—Corporation. Accepted. Cables for three years.—British Insulated Cables, Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bedlington.—Four British Restaurants; W. Hall, U.D.C. surveyor.

Chester.—Extensions, Liverpool Road; Williams & Williams, Ltd.
Extension, Walls Avenue; Pratt, Levick & Co., Ltd.
Extensions, Princess Street; Will R. Rose, Ltd.
Warehouse, Broughton; I. Barlow.
Restaurants (£3,000); city engineer.

Chesterfield.—Canteen, Grassmoor Colliery; R. Burtoft, engineer.

Croydon.—Buildings, site of Crown Hotel; Montague Burton, Ltd.

Darlington.—Storage house; Cleveland Bridge & Engineering Co., Ltd.

Doddington.—Alterations to Institution (£5,914); Isle of Ely county architect, March.

Doncaster.—Restaurant, High Street; borough engineer.

Durham.—Alternative accommodation for proposed remand home additions; F. Willey, architect, 34, Old Elvet.

Enfield.—Additions, High Street; A. J. Maxfield & Son.
Canteen, L.P.T.B. Depot, Southbury Road; L. A. Heaps.
Additions for Johnson & Son; H. St. Robinson.

Exeter.—Communal restaurants; city engineer.

Gateshead-on-Tyne.—British Restaurants; W. Hall, Ltd., Derwentwater Joinery Works, Gateshead; Elliott Bros., Ltd., Otterburn Terrace, Newcastle-on-Tyne; Norman Yeaman, Back Chandos Street, Gateshead.

Greenock.—Houses for Corporation; burgh surveyor.

Hanley.—Canteen, Ivy House Road; R. Goodwin & Sons, Ltd.

Jarrow-on-Tyne.—Cleansing station, Corporation Yard; J. S. Weir, borough engineer, Town Hall, Jarrow.

London. — FULHAM. — Shelters (£14,000); borough engineer.

Improvements to Trust dwelling shelters (£5,366); W. J. Marston & Son, Ltd.

ISLINGTON.—Day nurseries; E. C. P. Monson.

SOUTHWARK.—Restaurant, Camberwell Road; Miss E. L. Calkin.

Lowestoft.—Air-raid shelters (£6,200); borough engineer.

Middlesbrough.—Dairy extensions for the Co-operative Society; C.W.S. Architects' Department, 90, Westmorland Road, Newcastle-on-Tyne.

Gas cleansing station at Trinity Hall (£300); borough engineer.

Middlesex.—Canteen, West Middlesex Hospital (£700); county surveyor.

Newcastle-on-Tyne.—Decontamination station (£4,200); R. G. Roberts, 18, Cloth Market, Newcastle.

Stores to be converted into offices for Central Library; J. O. C. Solomon, city property surveyor, Town Hall, Newcastle.

Stockton-on-Tees.—British Restaurant (£1,400); A. S. Knolles, borough engineer.

Stoke-on-Trent.—Nursery, Greenbank Street, Tunstall; city architect.

Swansea.—School shelters (£8,500); borough architect.

Tynemouth.—Restaurants at Cullercoats (£600), and the East End (£300); borough engineer, 19 Howard Street, North Shields.

Reinstatement of the Princess Theatre, Russell Street; J. L. Ross, architect, Glasgow.

Reinstatement of Barclays Bank, Bedford Street; G. H. Gray, architect, Camden Street, North Shields.

Rebuilding livery stables, Albion Road, for E. Turnbull; J. R. Wallace, architect, 20, Northumberland Square, North Shields.

Restaurants, Cullercoats and East End; borough engineer.

Temporary rebuilding, Barclays Bank, Bedford Street; G. H. Gray, architect.

Wallsend.—Canteen and warehouse; R. Hood Haggie & Co., Ltd., Willington Quay.

Cape Town Load Development

ALTHOUGH the annual report of the city electrical engineer of Cape Town (Mr. G. H. Swingler, M.I.E.E.) for 1939 makes its appearance rather late it nevertheless contains interesting information. Hitherto the principal development has been in the domestic load (consumption for lighting, heating and cooking rose from 59 million kWh in 1933 to 151 million kWh in 1939) and Mr. Swingler draws attention to the economic danger inherent in the growth of a preponderating class of load of this kind. He considers that great potentialities exist for industrial expansion, and that the war especially may restore the port to its historic position as "the tavern of the seas." To encourage the establishment of new industries, however, it is necessary to provide cheap electricity, and this cannot be done if members of the Council regard the undertaking's surpluses as "easy money" for spending on other municipal activities.

A notable event during the year was the bringing into commercial operation of the Table Bay power station and the virtual completion of the work of providing facilities near the Salt River power station for obtaining sufficient sea water for any large new generating station that it might be necessary to build in the future. The fact that the more efficient plant in the Table Bay station was used to produce 65.7 per cent. of the total output during the year (377.3 million kWh) resulted in an increase in overall thermal efficiency from 19.4 to 21.5 per cent. The Table Bay thermal efficiency was 24.4 per cent., and it is expected that this will be improved when the station's "teething troubles" have been overcome.

Sales of electricity during the year amounted to 237.6 million kWh, an increase of 19.6 million kWh (of which 11.5 million kWh was due to domestic development). New consumers numbered 2,781, making 51,375 altogether. Early in the year the Department's new headquarters at Electricity House were completed. This imposing ten-storey building includes a basement housing an electricity substation and also a public restaurant. One floor is rented by the Electricity Supply Commission and the others are occupied by the Electricity and City Treasurer's Departments. There is an electricity showroom and a demonstration theatre.

Stereoscopic Television

FURTHER developments in television were demonstrated last week by Mr. J. L. Baird. They aimed at producing a stereoscopic effect in colour, and, although at present limited, effectively showed the possibilities.

In the demonstrations a 500-line picture was produced by employing a frequency of 150 a second with a scanning field of 100 lines interlaced five times. Successive 100-line frames were coloured green, red and blue.

A set of mirrors in front of the lens split up the light beam into two paths separated by a distance equal to the distance between the eyes. These beams scanned the scene alternatively to give a right and left-eye effect in rapid succession and the images were reproduced at the receiving end in such a way that each eye received separate "signals" and a sensation of depth was thereby imparted.

So far the system is limited to one observer who must keep his eyes upon the centre of the screen, but Mr. Baird claims that further developments will permit pictures to be projected on to a large screen.

Engineering
Library
JAN 27 1942

ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXIX. No. 3344 — DECEMBER 26, 1941 — 6d. WEEKLY

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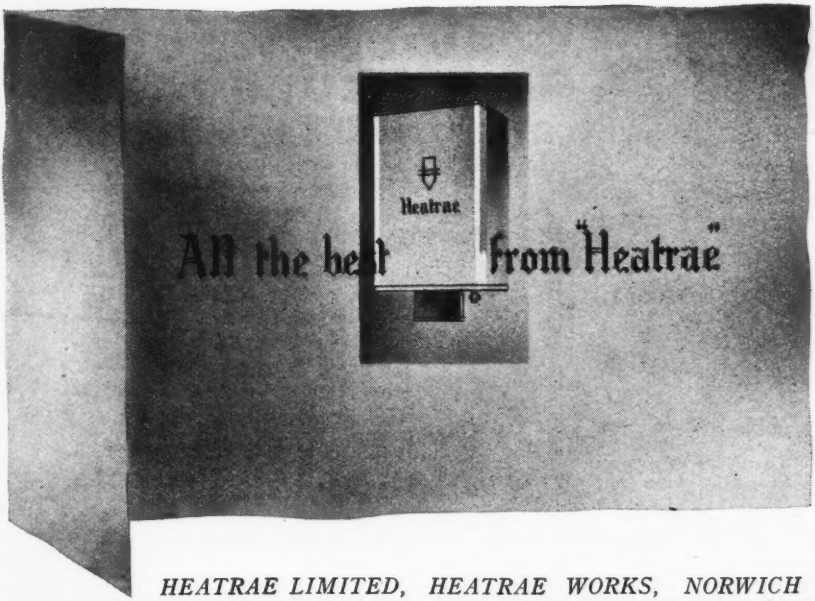
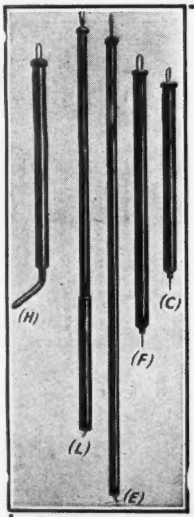


HEATRAE LIMITED, HEATRAE WORKS, NORWICH



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E	60,000	84"
F	15,000	48"
H	11,000	36"
L	33,000	72"

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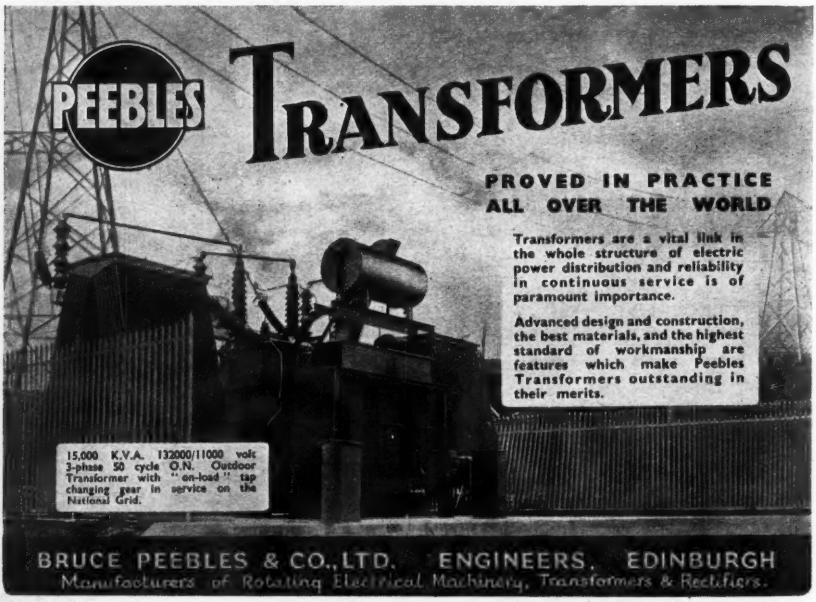
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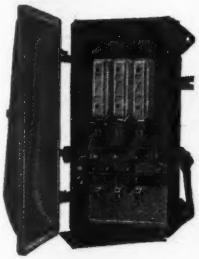

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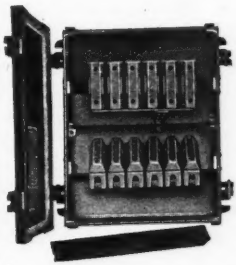

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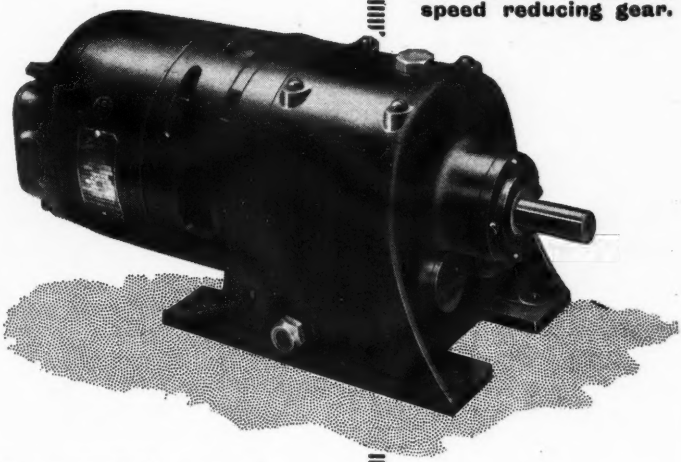

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DESIGNED for the PRODUCTION LINE

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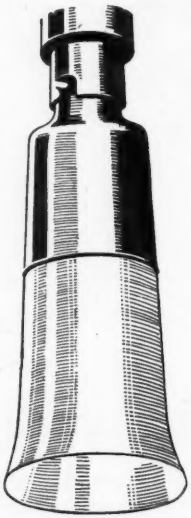

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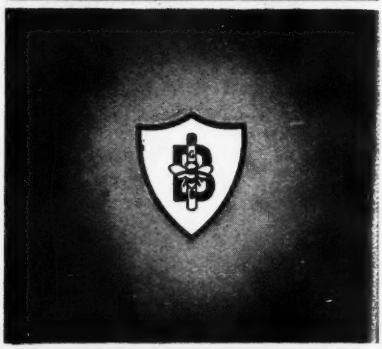

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This tube has been tested, passed and branded to British Standard Specification 31 33, and the "Bee" on every tube is your security — and ours.

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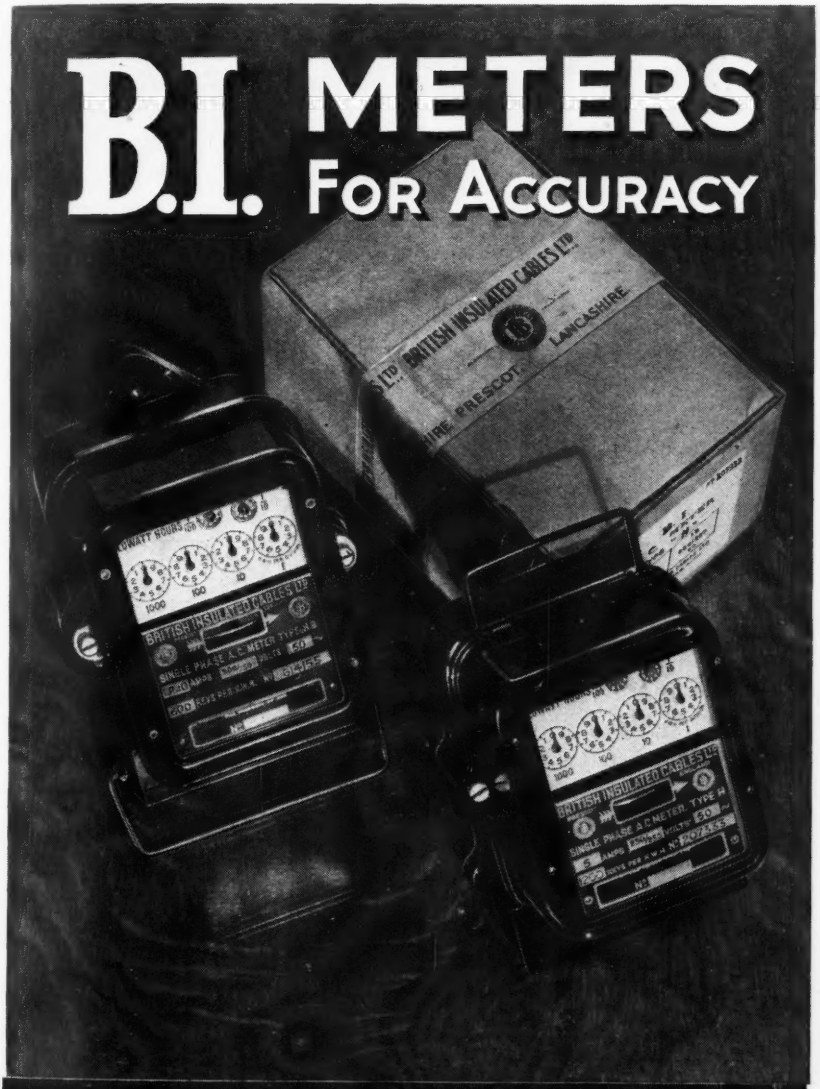
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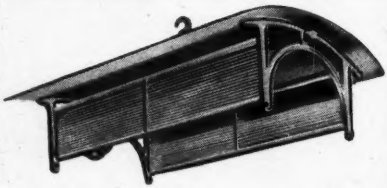
5 ELECO fittings

For the new Improved Factory Lighting Schemes



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of Electricity Distribution are cured by
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Since this advertisement first appeared in Oct. 1937 the number of Ferranti Voltage Regulators in use has been more than trebled.

X *Over 1,800 are now employed by Supply Authorities.*

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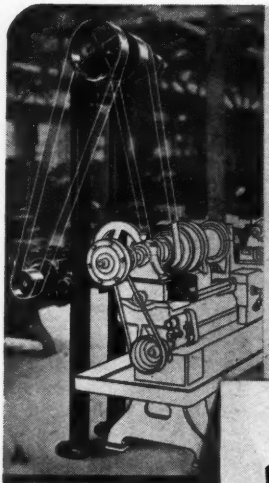

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Two-pillar Unit for use with any machine having a cone pulley drive.

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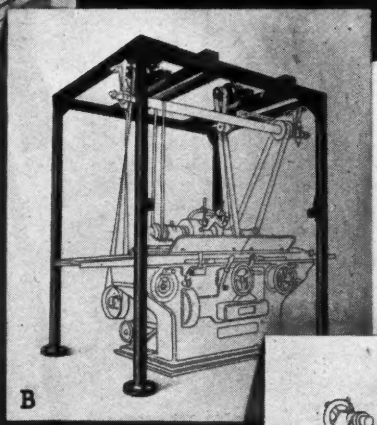
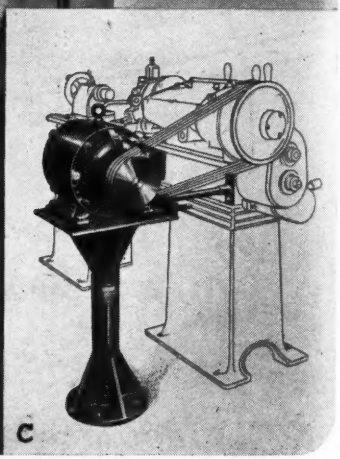
Four-pillar Unit for grinders and other machines having more than one belt drive.



B

TYPE C
Single-pillar Unit for all machines with single pulley drive.



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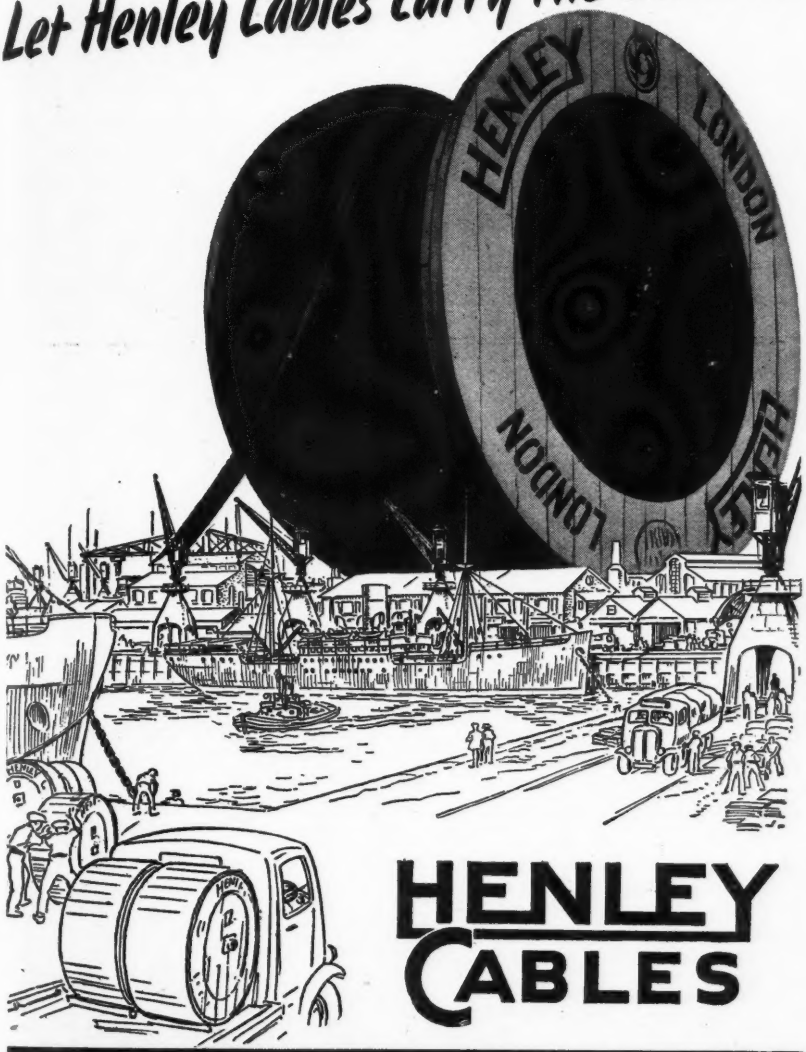

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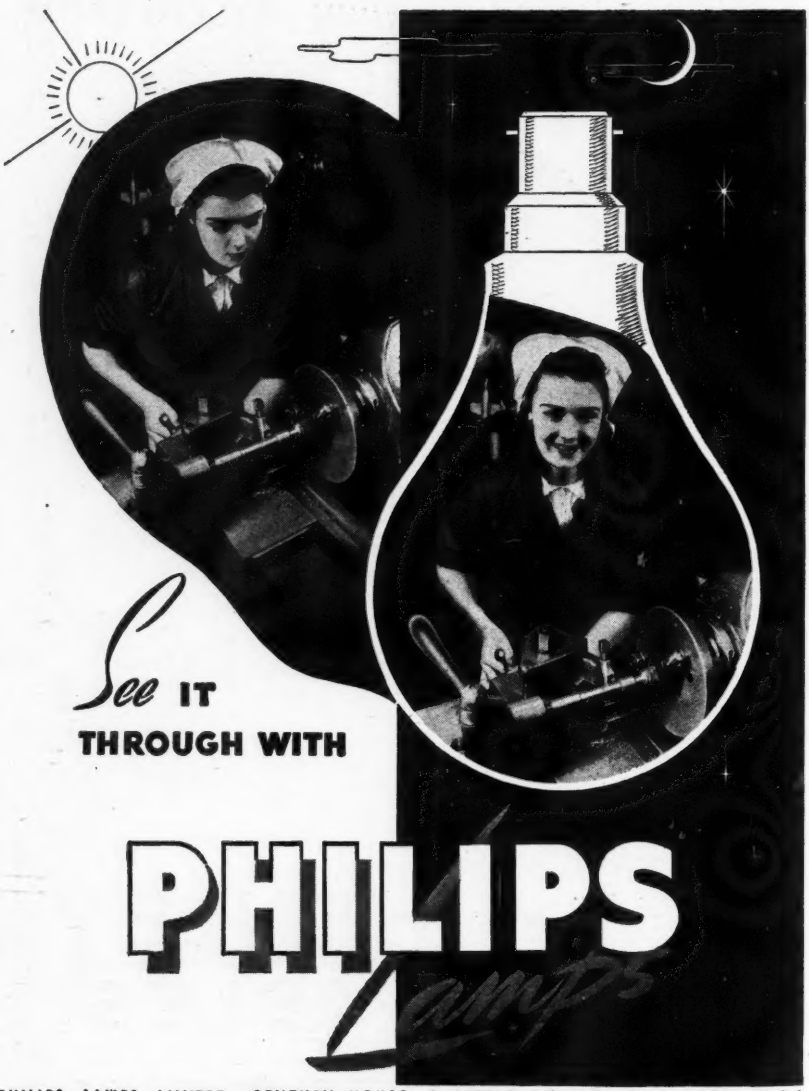

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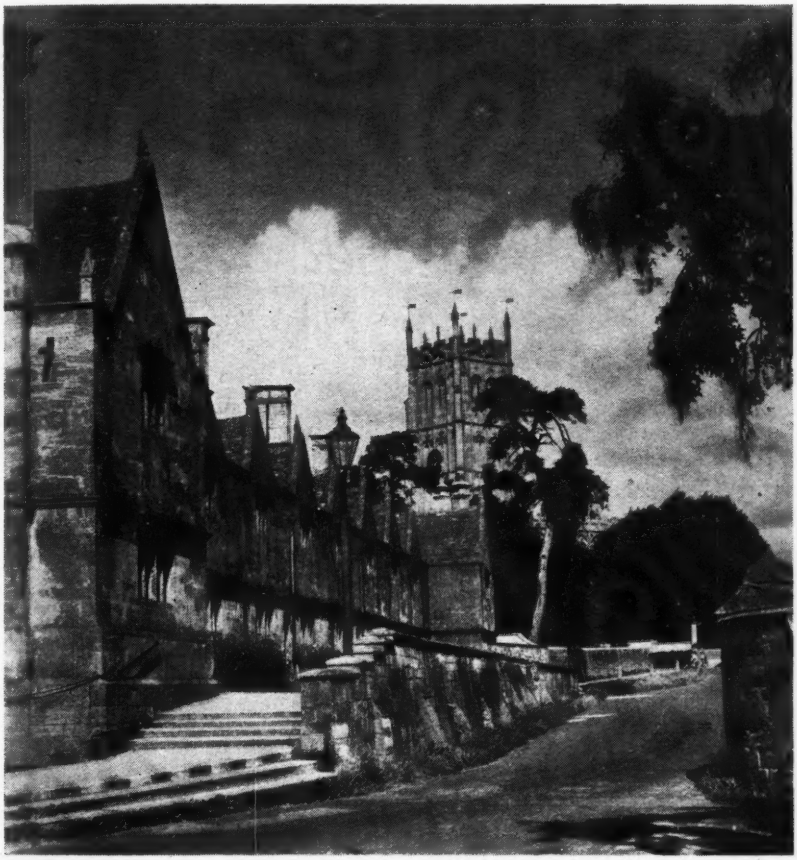

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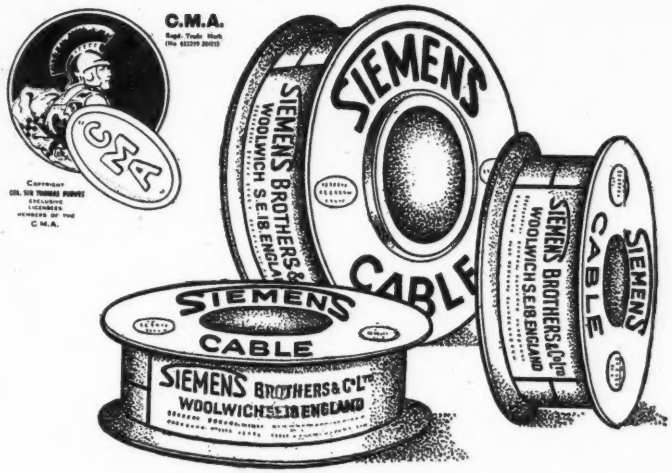

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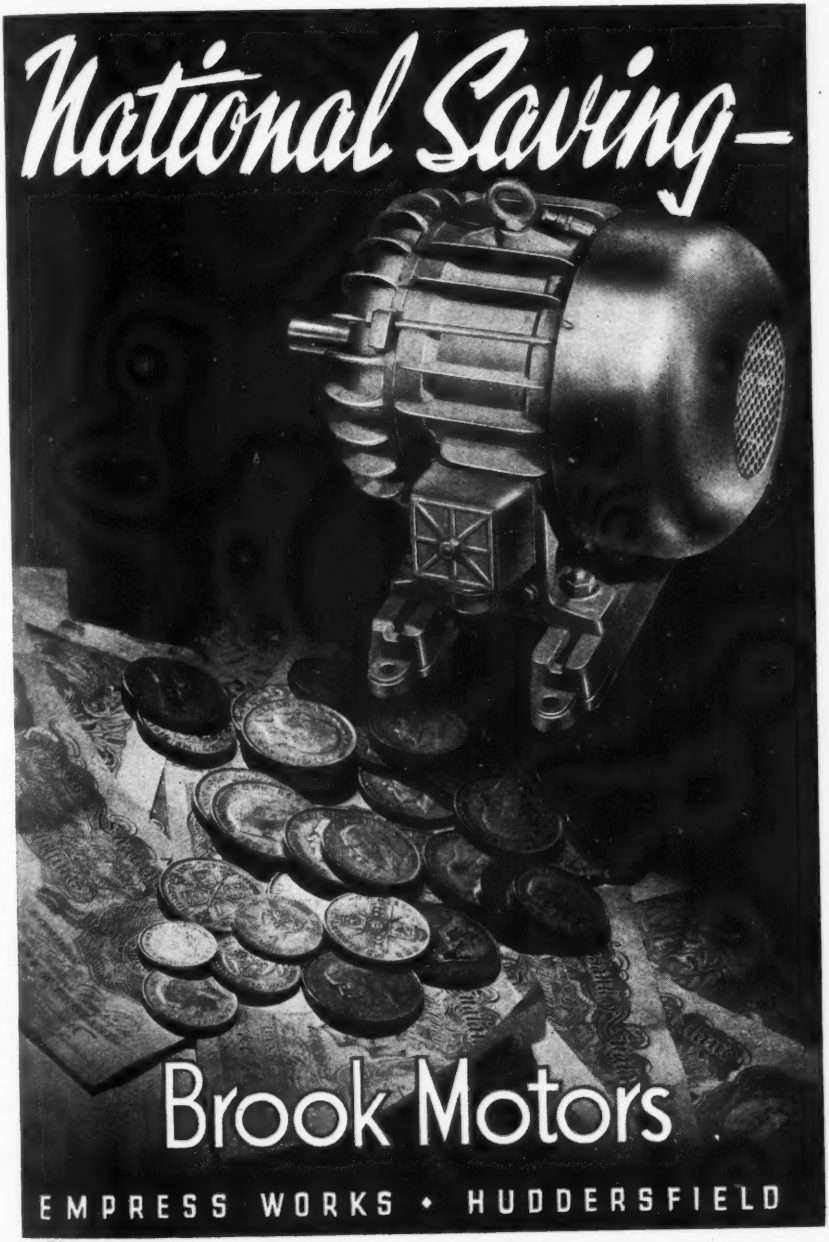

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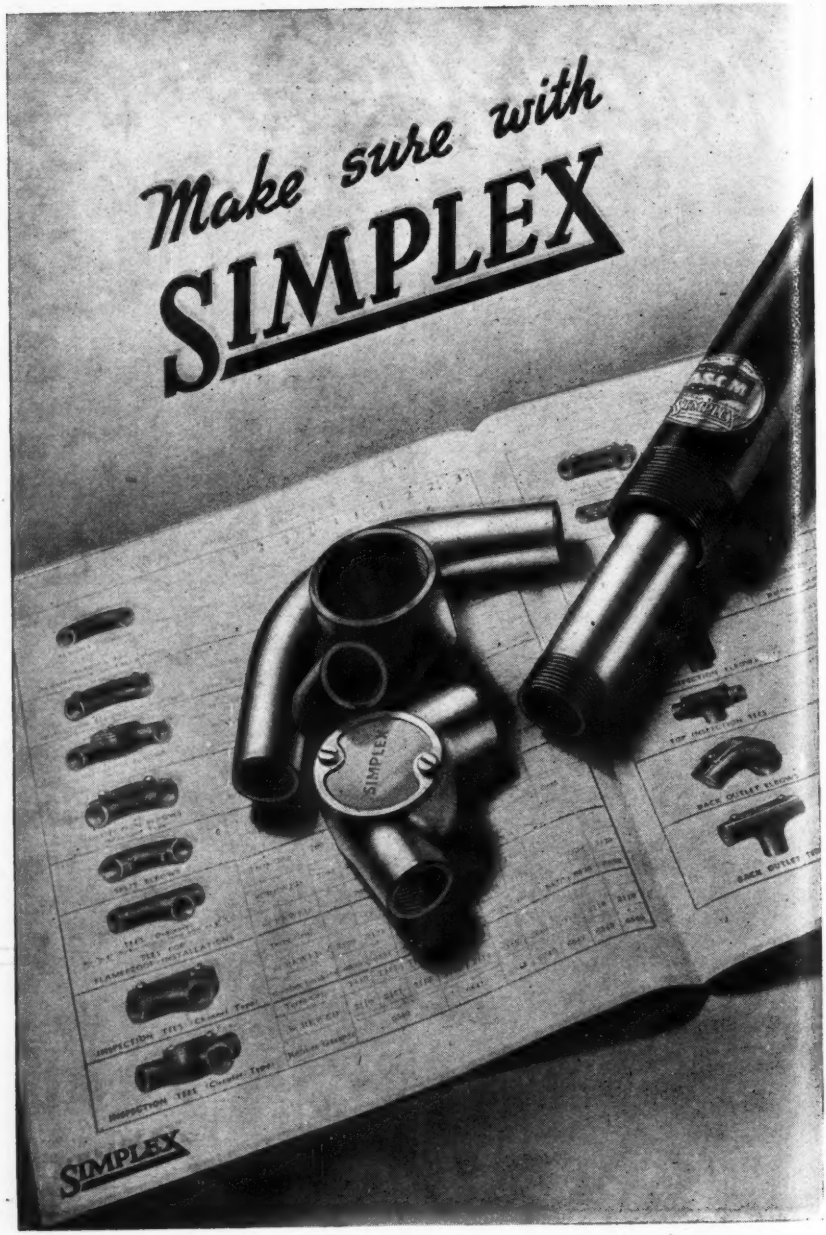
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SOLDERS AND **SOLDERING**

No. 3

Solder users are concerned with the whole operation of SOLDERING and not merely with the raw material, solder. Our ultimate interest is to sell the solder, but we are qualified to advise on all aspects of its application and the benefit of our very considerable experience and research is freely available to solder users.

Below are given some brief descriptions of a few special problems which we have investigated on the subject of the soldering of brass and copper. Perhaps you have a similar problem; or if you have any difficult soldering job in which the help of our technical staff might be useful, please tell us.

SOLDERING OF BRASS AND COPPER

EXTRACTS FROM TECHNICAL REPORT

Hot dipping of D.C. Armatures

Description of the use of high temperature soft solders, with a non-corrosive flux, to provide a margin of safety at the operating temperatures.

Hot dipping of Tungum Tubing

Investigation of the preparation of the tubes preparatory to tinning to overcome previous difficulties due to patchy coatings.

Soldering of Squirrel Cage Rotor

Describes solder having good electrical conductivity and resistance to the high temperatures encountered.

Soldering of Brass with Fusible Alloy

Cracking of the enamel coating on a brass blade was eliminated by the use of a low melting point alloy having good soldering properties.

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Cleaning, fluxing, dipping and finishing procedure is described and an account is given of the precautions to be taken.

Soldering of Phosphor Bronze Tube

Method of soldering very narrow tube used in oxygen breathing apparatus to ensure freedom from obstruction or corrosion.

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Recommends a safety flux to avoid corrosion due to the flux as used hitherto.

Soldering of Electro Tinned Brass

Faulty adhesion of the solder is avoided either by the use of an active flux or by a modification in the electro tinning procedure.

Hot dipping of Brass Gauze

The gauze was coated with pure tin by dipping. Trouble experienced through rapid contamination of the bath by copper was minimised by the use of a suitable solder.

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Difficulty was encountered in soldering as the flux did not remove the surface skin of aluminium oxide. A procedure eliminating the difficulty was detailed.

TECHNICAL LEAFLET No. 10

"Solders for Dipping Work"

Deals with the hot dipping of steel, brass and copper. Preliminary cleaning; fluxing; dipping; covering flux; cleaning and refining fluxes; suggested layouts for dipping plant; periodical analysis; dross collection; thermometers and pyrometers.

It gives the best dipping temperatures to follow and technical details of various dipping solders.

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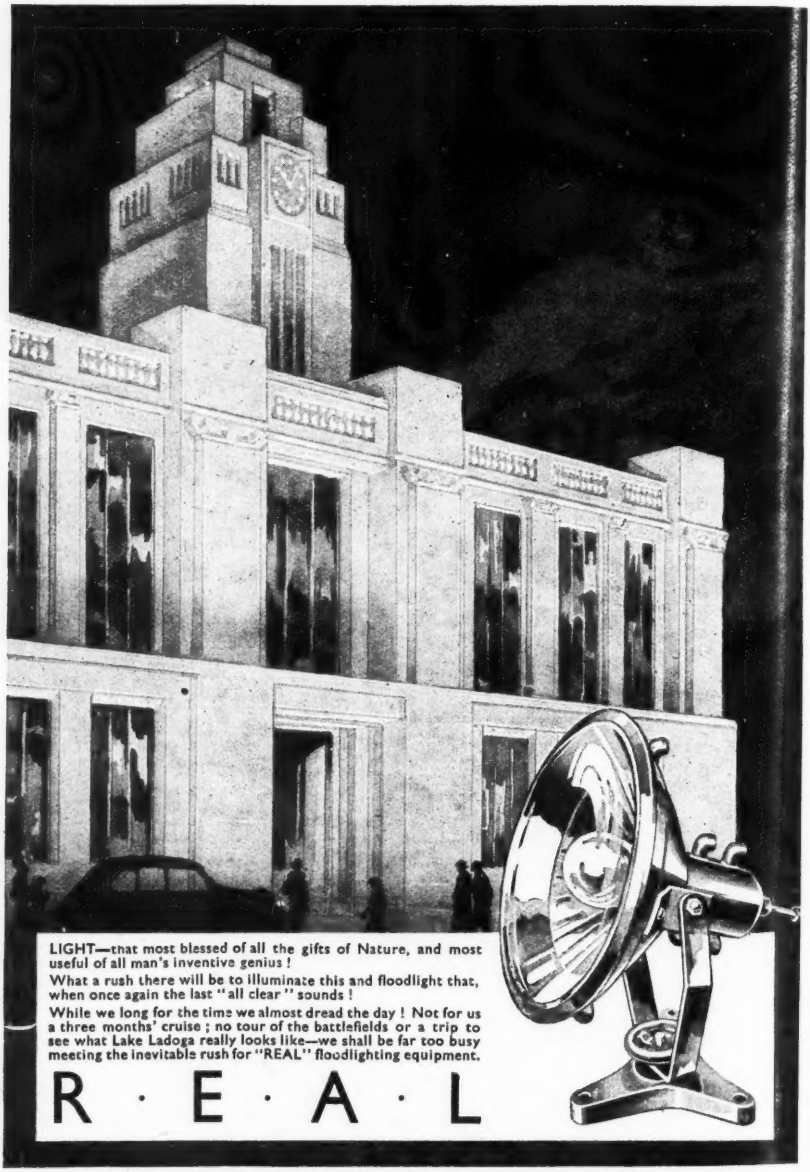
LIGHT—that most blessed of all the gifts of Nature, and most useful of all man's inventive genius !
What a rush there will be to illuminate this and floodlight that, when once again the last "all clear" sounds !
While we long for the time we almost dread the day ! Not for us a three months' cruise ; no tour of the battlefields or a trip to see what Lake Ladoga really looks like—we shall be far too busy meeting the inevitable rush for "REAL" floodlighting equipment.
R · E · A · L

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WITH THE UTMOST RELIABILITY

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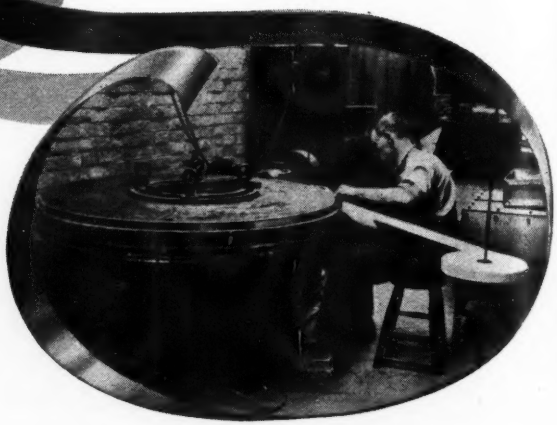
The most up-to-date precision machinery and highest quality materials are employed in the manufacture of Anacos Copper Strip, with consequent accuracy and reliability.



Anacos Copper Strip being used in the manufacture of a circular Lifting Magnet.

TELEPHONE BLACKFRIARS 8701 (8 lines)

FREDERICK SMITH & COMPANY
(INCORPORATED IN THE LONDON ELECTRIC WIRE COMPANY AND SMITHS, LIMITED)
ANACONDA WORKS, SALFORD, 3, LANCS.

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FUSEGEAR

High Rupturing Capacity
Non-deteriorating

CARTRIDGE-FUSE LINKS

Install 'English Electric' and be Safe

"English Electric" Cartridge-Fuse Links, Indicating Type are available up to 800 amps. and comply with B.S.S.88/1939, Categories 440.A C.4 and D.C.4

A complete range of Metalclad and open type apparatus incorporating "English Electric" Fuses is also available

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E.L.M.A. LAMPS.
MADE IN ENGLAND.

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Branches holding stocks from which supplies can be obtained :—

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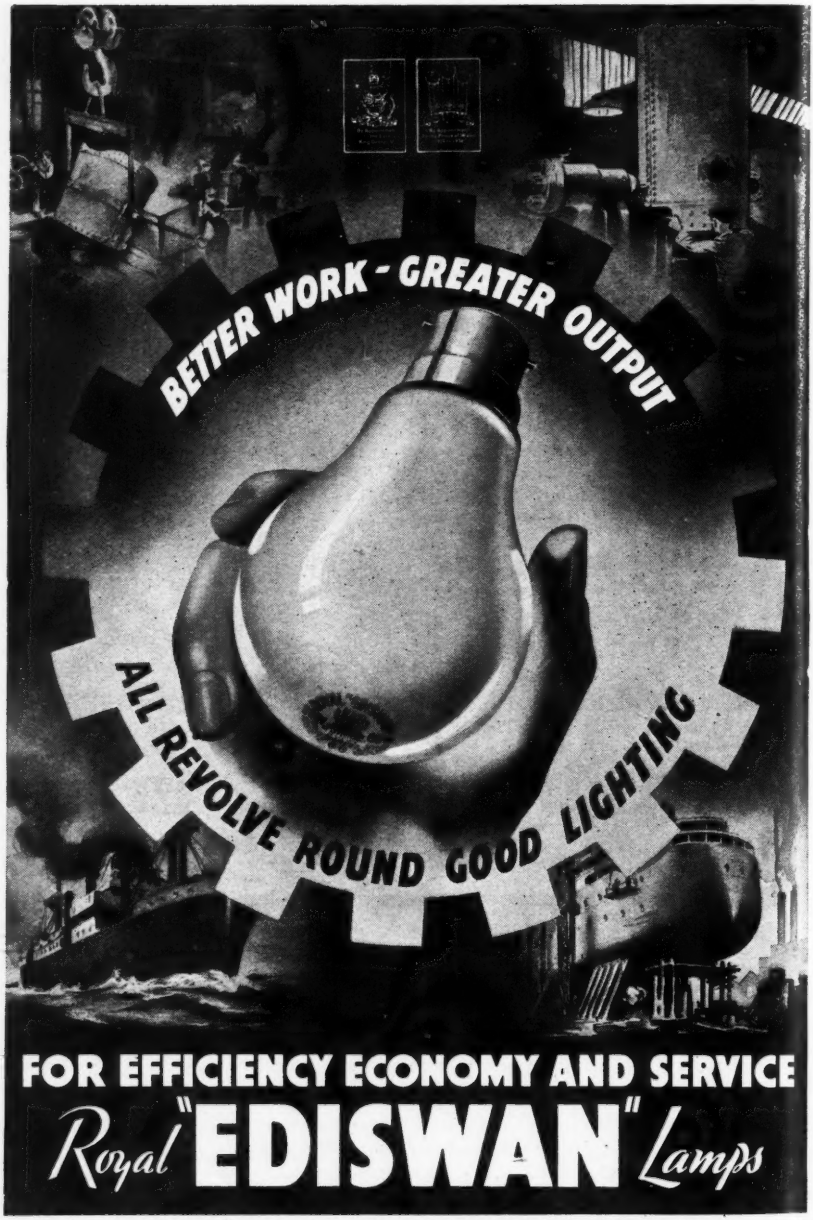
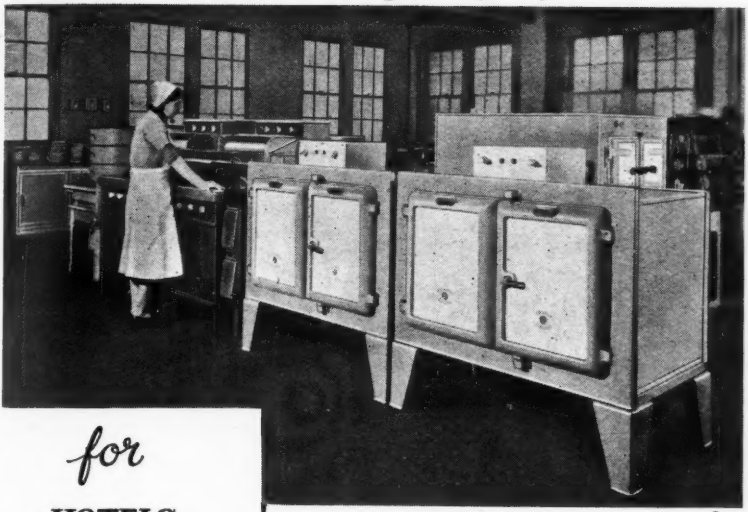


THE EDISON SWAN ELECTRIC CO. LTD. 155 CHARING CROSS ROAD, W.C.2 (L.23)

'ENGLISH ELECTRIC'

Heavy-duty Electric Cooking Equipment



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and make the utmost use of available kitchen space

"English Electric" Heavy-duty Electric Cooking Equipment is specially designed to meet present-day requirements.

The equipment illustrated, installed in a large industrial canteen, includes roasting ovens, fish fryer, hot-cupboards, griller and boiling tables.

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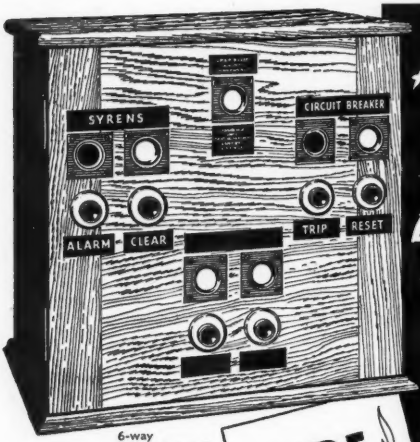

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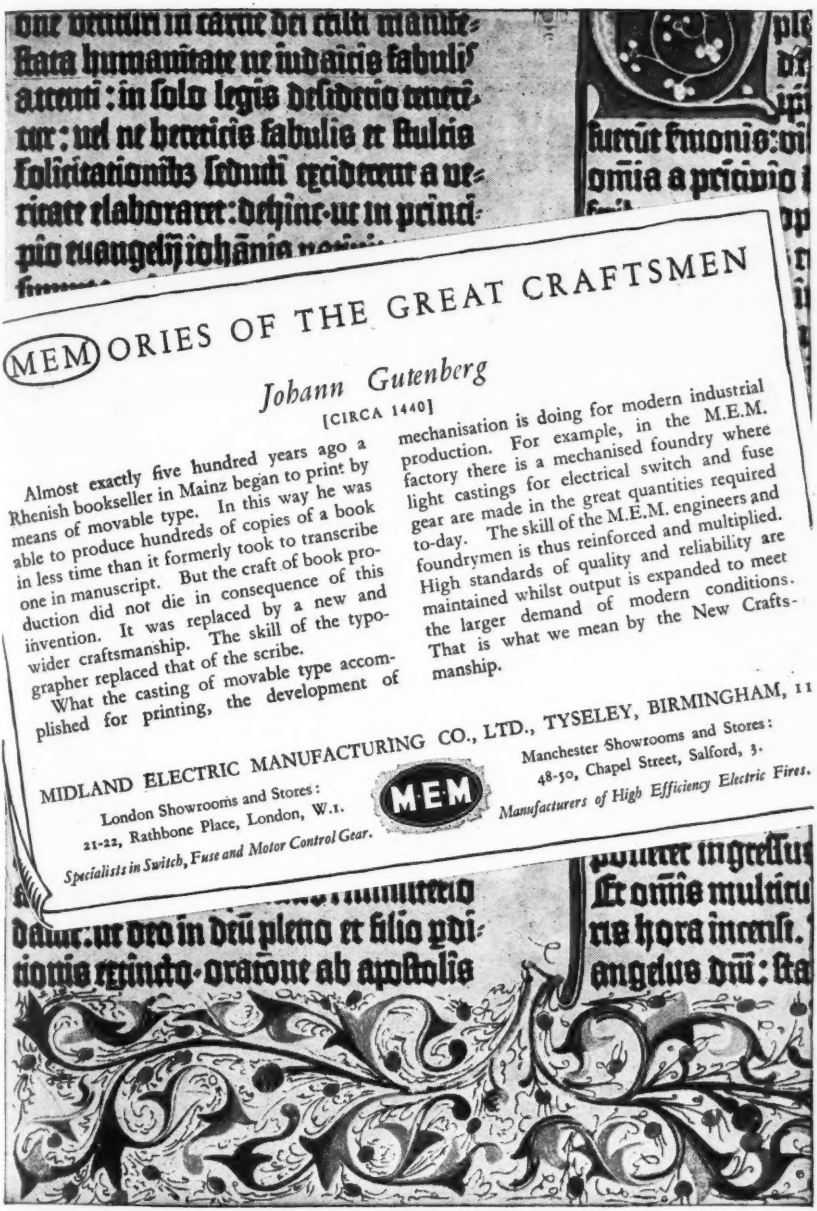

MEMORIES OF THE GREAT CRAFTSMEN

Johann Gutenberg

[CIRCA 1440]

Almost exactly five hundred years ago a Rhenish bookseller in Mainz began to print by means of movable type. In this way he was able to produce hundreds of copies of a book in less time than it formerly took to transcribe one in manuscript. But the craft of book production did not die in consequence of this invention. It was replaced by a new and wider craftsmanship. The skill of the typographer replaced that of the scribe.

What the casting of movable type accomplished for printing, the development of mechanisation is doing for modern industrial production. For example, in the M.E.M. factory there is a mechanised foundry where light castings for electrical switch and fuse gear are made in the great quantities required to-day. The skill of the M.E.M. engineers and foundrymen is thus reinforced and multiplied. High standards of quality and reliability are maintained whilst output is expanded to meet the larger demand of modern conditions. That is what we mean by the New Craftsmanship.

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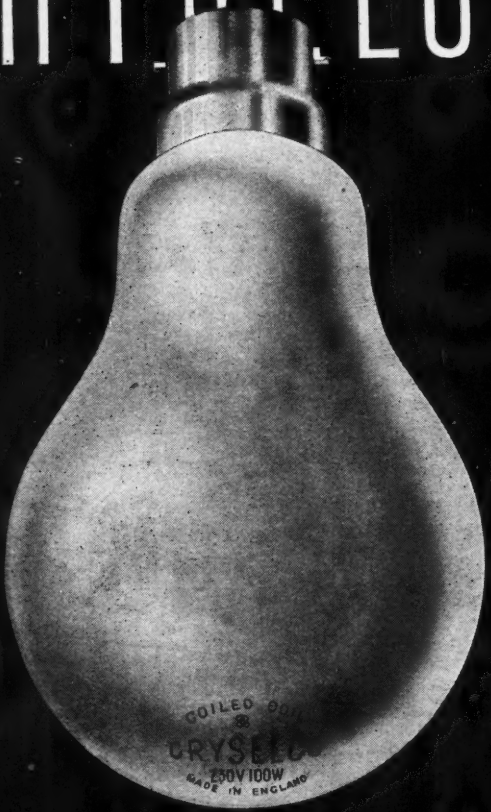

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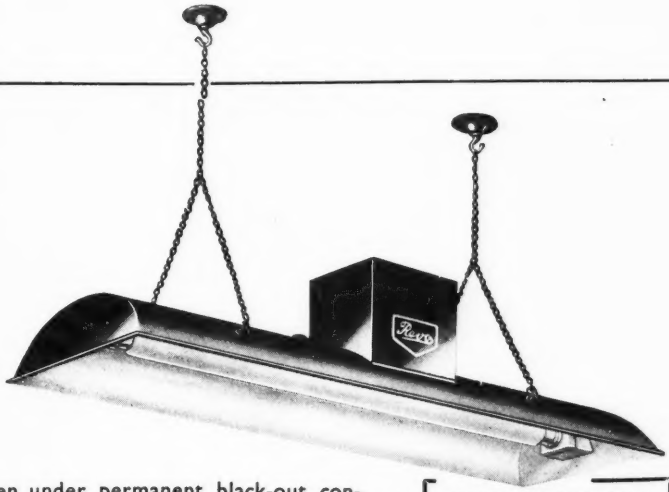

even under permanent black-out conditions, can now be assured by the installation of **REVO "FLUOROLITE" REFLECTORS** with 80-watt Mercury Fluorescent Tubular Lamps. The employment of these Units banishes visual strain, increases production and reduces running costs.

***REVO "FLUOROLITE" REFLECTORS** are of substantial construction, being produced from heavy gauge sheet steel, finished inside in white enamel and outside in silver grey. Chain or rigid suspension can be provided, and the Units are available with or without housing for control gear.*
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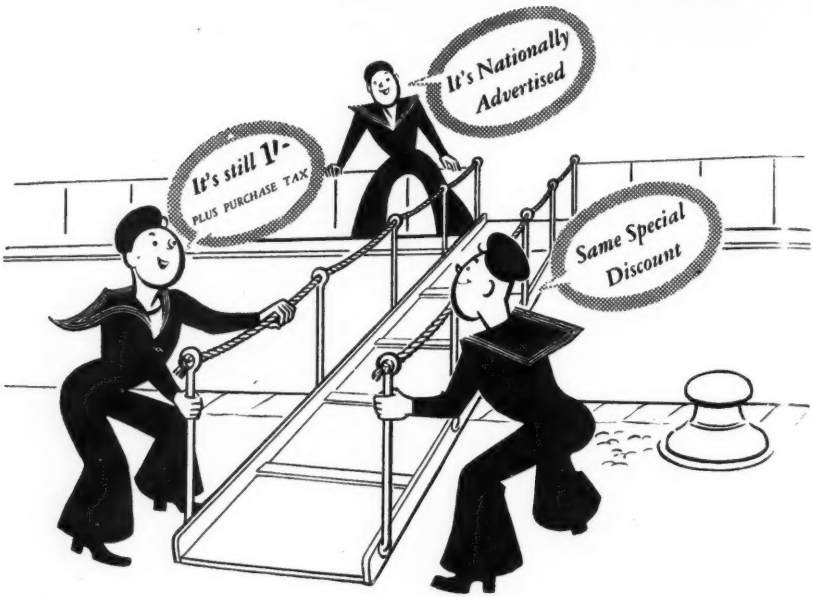

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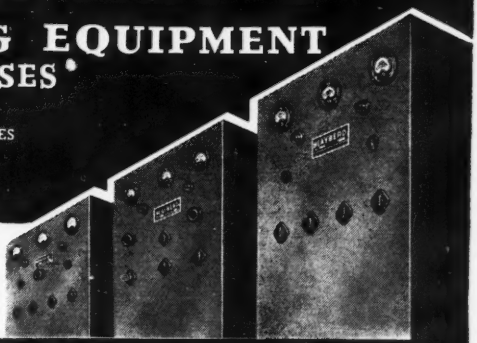

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2—Have you installed labour-saving equipment to speed up loading and unloading? If this is not possible, have you improvised?

3—Do you help consignees by informing them, as far as you can, when the goods you forward may be expected to arrive?

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5—Have you talked the matter over with the men who actually load and unload?

6—Do you make the most of every hour of daylight to clear loads, carrying on into the blackout when possible?

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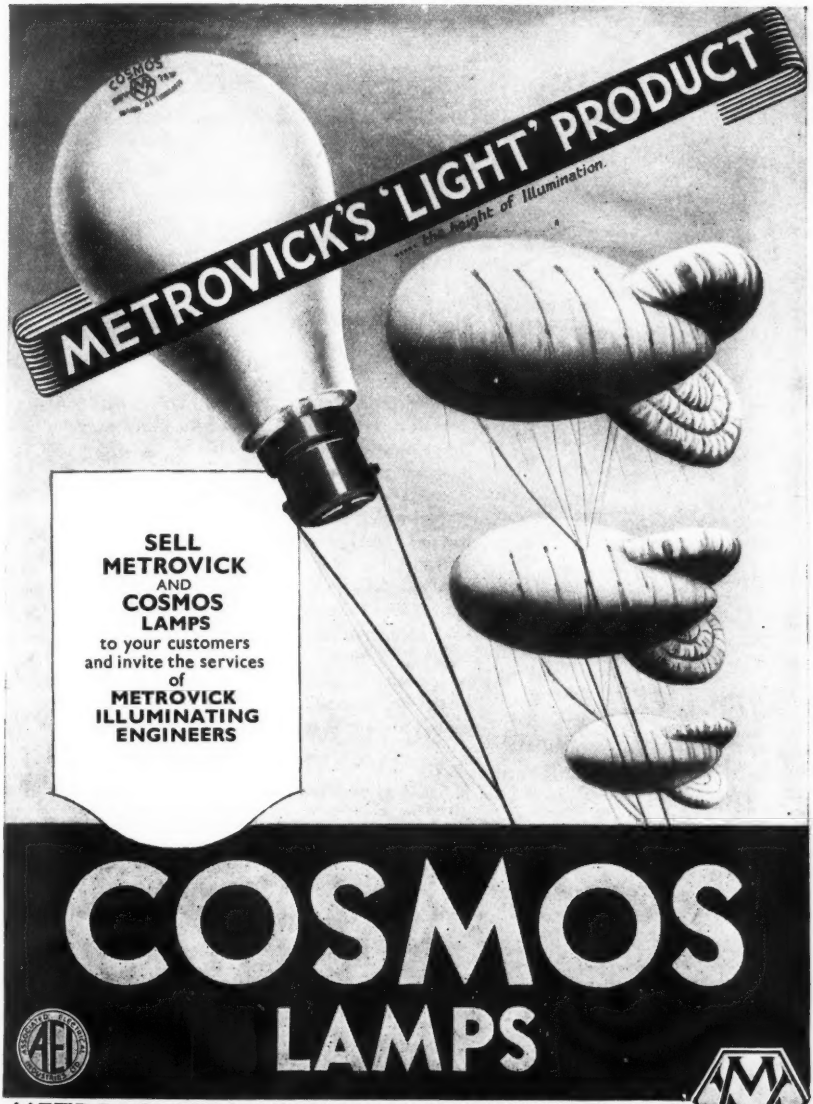

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No. 1 OF A SERIES

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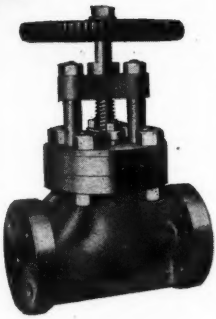

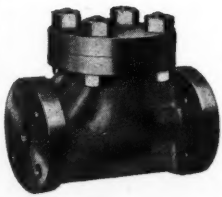

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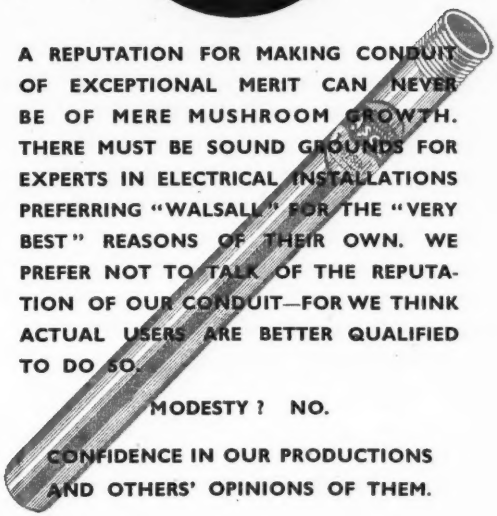

A REPUTATION FOR MAKING CONDUIT OF EXCEPTIONAL MERIT CAN NEVER BE OF MERE MUSHROOM GROWTH. THERE MUST BE SOUND GROUNDS FOR EXPERTS IN ELECTRICAL INSTALLATIONS PREFERRING "WALSALL" FOR THE "VERY BEST" REASONS OF THEIR OWN. WE PREFER NOT TO TALK OF THE REPUTATION OF OUR CONDUIT—FOR WE THINK ACTUAL USERS ARE BETTER QUALIFIED TO DO SO.

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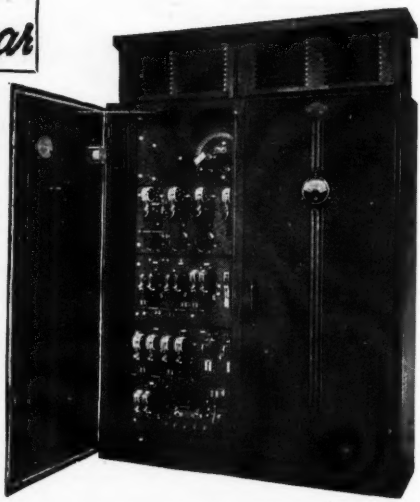

Illustration shows three-motor control panel for large boring machine.

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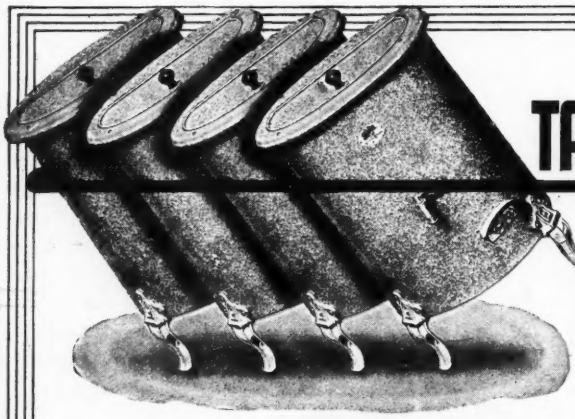

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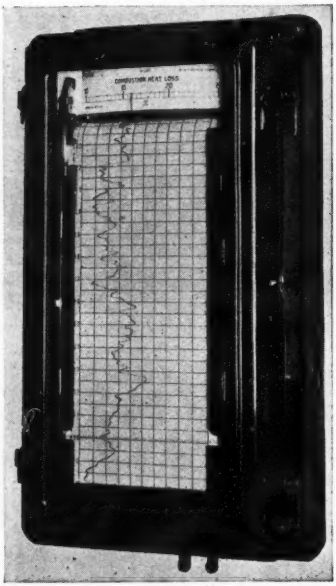

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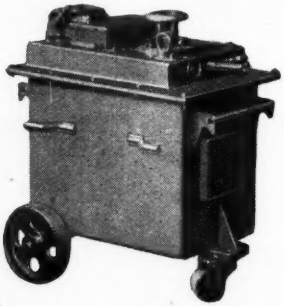

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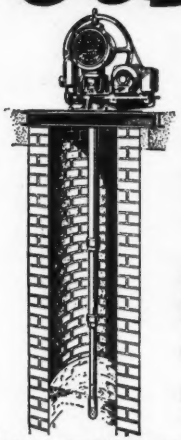

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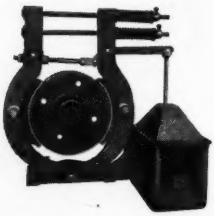

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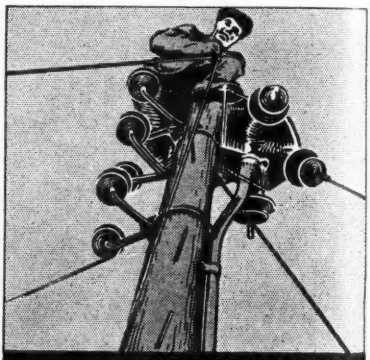

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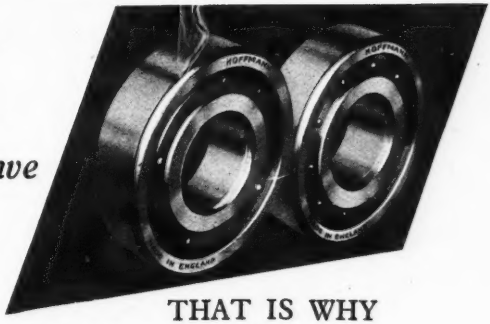

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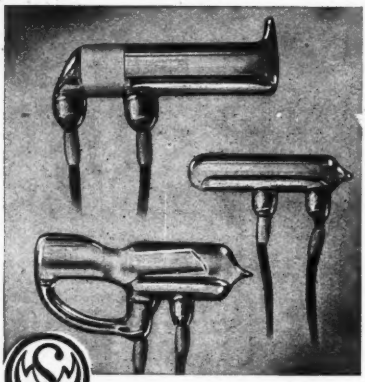

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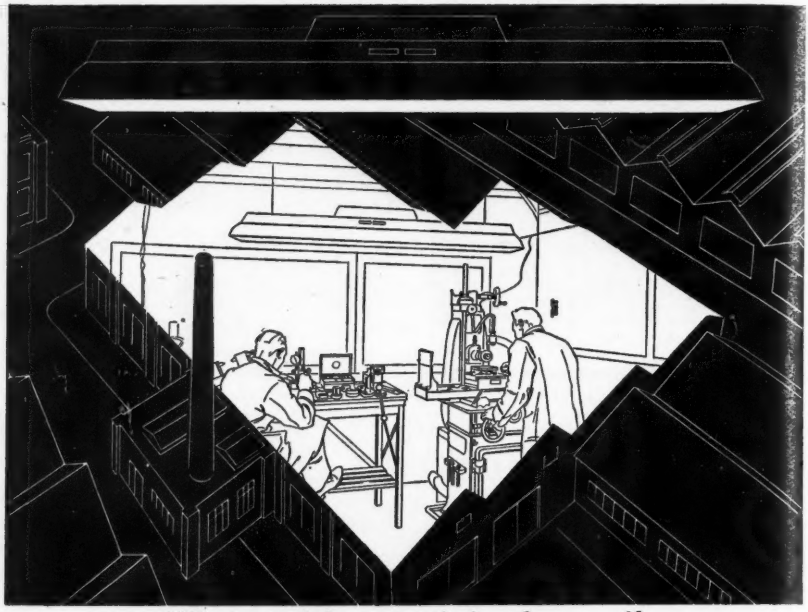

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THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number there is an additional charge of 6d. for postage of replies.
SITUATIONS WANTED.—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed.

Original testimonials should not be sent with applications for employment.

SITUATIONS VACANT

TYNE IMPROVEMENT COMMISSION

Appointment of Electrical Engineer

THE Tyne Improvement Commissioners invite applications from qualified persons for the position of Electrical Engineer under their Engineer-in-Chief, Mr. R. F. Hindmarsh, M.Inst.C.E.

Applicants must be Corporate Members of the Institution of Electrical Engineers. They should have practical experience in the design, operation and maintenance of Dock and Harbour electrical installations, both A.C. and D.C., and be competent to take charge of the maintenance of such installations, and also to draw up specifications for new works, etc.

Salary £700 per annum (excluding War Bonus), rising by annual increments of £25 to a maximum of £800.

Applications, accompanied by not more than three recent testimonials, will be received up to the 12th of January, 1942, and should be addressed to the Chairman and marked "Electrical Engineer."

The person appointed will be required to reside in the district and devote himself exclusively to the service of the Commissioners, to submit to medical examination and be subject to the provisions of the Tyne Commission Superannuation Fund.

Canvassing will be a disqualification.

By Order,
J. K. McKENDRICK,
Secretary.

Tyne Improvement Commission,
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16th December, 1941. 1403

ASSISTANT to Purchasing Manager, also two Storekeepers required by important electrical/radio firm in Central London handling priority contracts. Salaries £300, £200 respectively. Must be exempt military service. Full details age, qualifications, experience to—Box 1396, c/o The Electrical Review.

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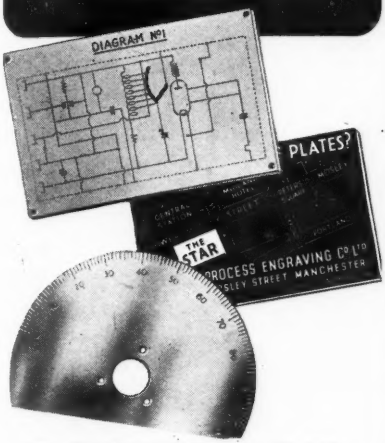

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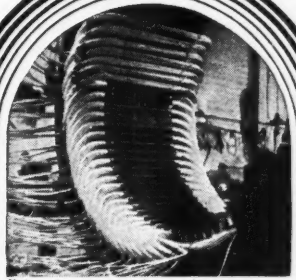

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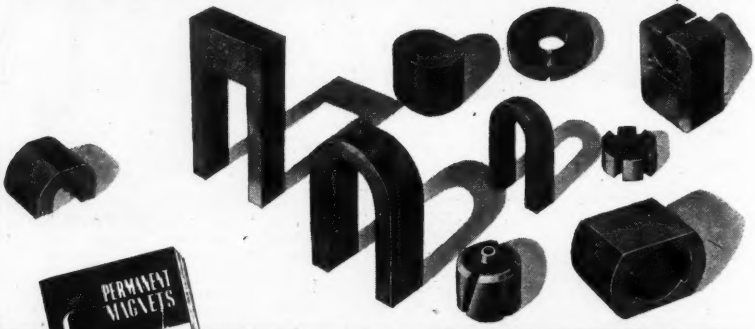

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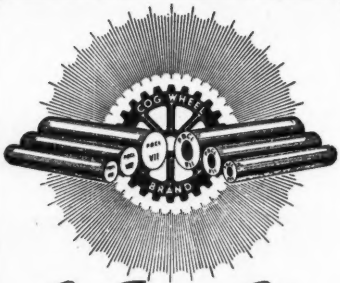

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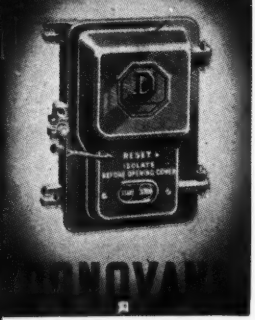

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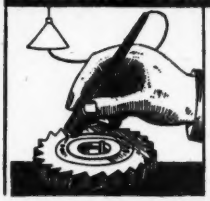

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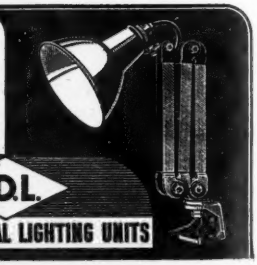

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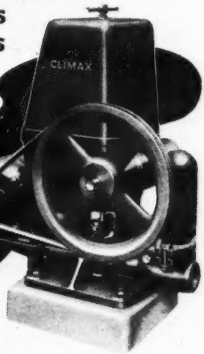

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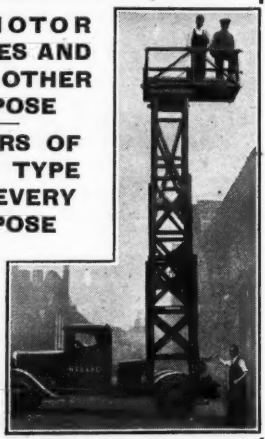

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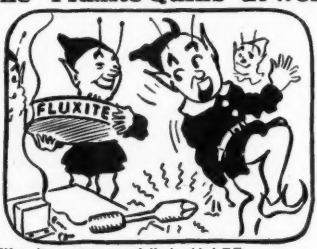

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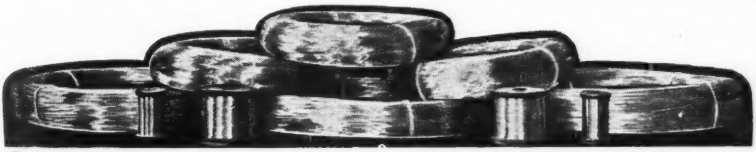

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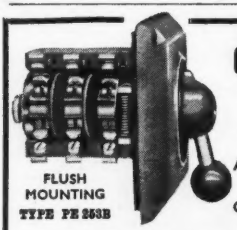

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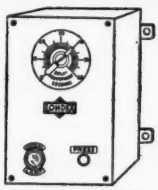

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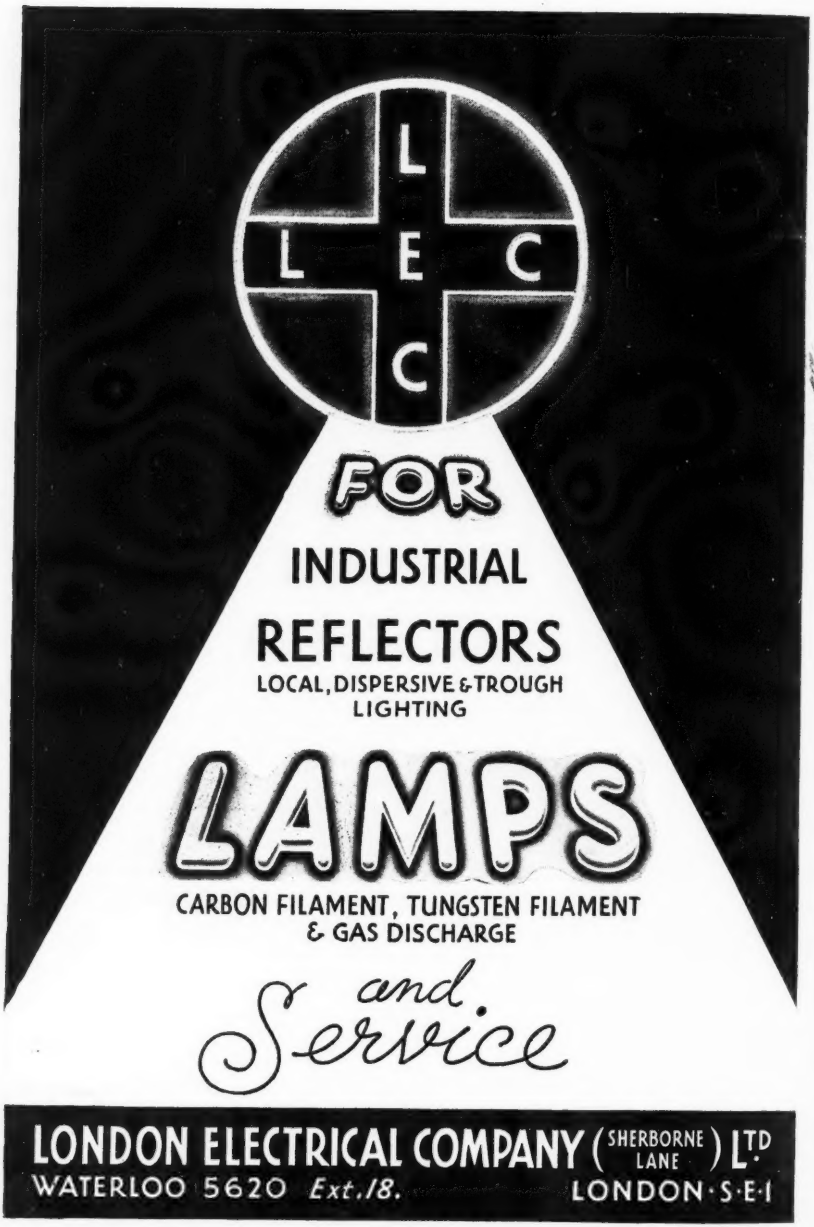
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